Exhibit 14

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

APPLE INC., a California corporation, Plaintiff, v. SAMSUNG ELECTRONICS CO., LTD., a Korean corporation; SAMSUNG ELECTRONICS AMERICA, INC., a New York corporation; and SAMSUNG TELECOMMUNICATIONS AMERICA, LLC, a Delaware limited liability company, Defendants.	Case No. 11-cv-01846-LHK **EXPERT REPORT OF MICHEL MAHARBIZ, PH.D. REGARDING INFRINGEMENT OF U.S. PATENT NOS. 7,663,607 AND 7,920,129**

<u>CONFIDENTIAL – CONTAINS MATERIAL DESIGNATED AS HIGHLY CONFIDENTIAL – ATTORNEYS' EYES ONLY PURSUANT TO A PROTECTIVE ORDER**</u>**

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I, Michel Maharbiz, Ph.D., submit the following expert report ("Report") on behalf of plaintiff Apple Inc. ("Apple").

I. INTRODUCTION

1. This Report covers my review, analysis, and opinions regarding infringement of United States Patent Nos. 7,663,607 ("the '607 Patent") and 7,920,129 ("the '129 Patent") asserted by Apple against Samsung Electronics Co., Ltd., Samsung Electronics America, Inc., and Samsung Telecommunications America, LLC (collectively "Samsung") in Case No. 11-cv-01846-LHK pending in the United States District Court for the Northern District of California. I have been retained to consult with counsel, review documents and other information, prepare expert reports, and be available to testify regarding my opinions in connection with litigation brought by Apple against Samsung. My opinions are set forth below in this report and in the accompanying exhibits.

2. I am being compensated for my work in connection with this matter at the rate of $300 per hour. I also get reimbursed for reasonable travel and out-of-pocket expenses in relation to my work on this case. My compensation is not contingent upon the outcome of this case. Neither the amount of my compensation nor my hourly billing rate depends on whether I am obligated to testify at deposition or trial.

3. I expect to testify at trial regarding the matters expressed in this report and any supplemental reports that I may prepare for this litigation. I also may prepare and rely on audiovisual aids to demonstrate various aspects of my testimony at trial. I also expect to testify with respect to any matters addressed by any expert testifying on behalf of Samsung, if asked to do so. I reserve the right to supplement or amend this Report, if additional facts and information that affect my opinions become available. In particular, I understand that fact discovery closed on March 8, 2011. I have been informed that Samsung has yet to complete production of information that may affect my Report and analysis. Therefore, my investigation into the specifics and extent of Samsung's infringement is ongoing. My Report is based on the materials that have been available to me up to the date of this Report.

II. QUALIFICATIONS

4. Information detailing my qualifications is included in my Curriculum Vitae, attached as Exhibit A. I received my Ph.D. in Electrical Engineering and Computer Science from the University of California at Berkeley ("Berkeley") in 2003. I received a Bachelor's of Science degree in Electrical Engineering and Computer Science from Cornell University in 1997. My Ph.D. thesis was on the topic of microfabrication and miniaturization of instrumentation. Before I joined the faculty of Berkeley, I was an Assistant Professor at the Electrical Engineering and Computer Science Department at the University of Michigan at Ann Arbor.

5. I am currently an Associate Professor of Electrical Engineering and Computer Science ("EECS") at Berkeley. I am also a Co-Director of the Berkeley Sensor and Actuator Center (BSAC), which is the National Science Foundation Industry/University Cooperative Research Center for Microsensors and Microactuators. BSAC conducts industry-relevant, interdisciplinary research on micro- and nano-scale sensors, moving mechanical elements, microfluidics, materials, processes and systems that combines knowledge of integrated-circuit, biological, and polymer technologies.

6. The courses I have taught at Berkeley include EE147 ("Introduction to Microelectromechanical Systems (MEMS)"), EE40 ("Introduction to Microelectronic Circuits"), CS150 ("Components and Design Techniques for Digital Systems") and EE105 ("Microelectronic Devices and Circuits"). A list of my publications is included in my Curriculum Vitae (Exhibit A), and includes a textbook on circuits as well as more than 40 journal and technical conference publications in high impact venues. My research at Berkeley has covered a variety of topics, including the extreme miniaturization of electronic systems for neural recording and stimulation, microfabrication of flexible polymer microelectrocorticography arrays, energy scavenging devices for ultra-low power CMOS circuits, and microfluidic component design among others. My current research interests include building micro/nano interfaces to cells and organisms and exploring bio-derived fabrication methods. I was the recipient of a 2009 NSF Career Award for research into developing microfabricated interfaces for synthetic biology.

7. My research activities have been funded by DARPA, NSF, NIH, and the U.S. Army. My research has also been partially funded over the last several years by grants from private companies. Such grants are usually designated as intended to support a specific research project or research center, and are not gifts to me personally.

8. As of February 18, 2012, I am listed as co-inventor of U.S. Patent Application Nos. 20100331083, 20100004062, and 20090085427. Each is accessible via http://appft1.uspto.gov/netahtml/PTO/search-bool.html.

III. MATERIALS CONSIDERED AND RELIED ON

9. In arriving at my opinions provided in this Report, I have considered a number of different sources of information that are identified in attached Exhibit B and/or referenced in my report.

10. In particular, I have reviewed the '607 and '129 Patents and their respective file histories; and documentation made publicly available and produced by Samsung during the course of discovery. I have also examined the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 products.[1] In support of my analysis and rendered opinions, I asked to have detailed physical analyses ("tear-downs") performed on the Samsung Galaxy Tab 7.0 and Samsung Galaxy Tab 10.1. These tear-downs were completed by EAG Labs under my control and direction. The summaries and reports of Ian Ward of EAG Labs are attached as Exhibits C and D.

11. In addition to the materials specifically identified, I may provide further exhibits to be used at trial in support of my opinions. In particular, if called to testify or to give additional opinions regarding this matter, I reserve the right to rely upon additional materials that may be provided to me or that are relied upon by any of Samsung's experts or witnesses.

IV. UNDERSTANDING OF THE LAW

12. As an expert assisting the Court and jury in determining infringement, I understand that I am obliged to follow existing law. I have therefore been asked to apply the following legal principles to my analysis of infringement:

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[1] In my opinions in this report, the Galaxy Tab 10.1 refers to both the WiFi and LTE versions.

13. I understand that to determine whether there is infringement of a patent: (1) the claims of the patent must be construed; and (2) the properly construed claims must then be compared with the accused products. I understand that the parties have proposed differing constructions of certain terms in the ’607 and ’129 Patents, and that the parties may have differing constructions of terms that were not part of the claim construction hearing and for which no claim construction Order has been issued. As no constructions have yet been issued, in any case, I have interpreted the claims as one of ordinary skill in the art would have at the time the relevant patent was filed in light of the teachings of the patent and its prosecution history.

14. I understand that in construing claims of a patent one should first consider the intrinsic evidence, which includes the patent’s claim language, its specification, and its prosecution history. In particular, I should first consider the words of the claims themselves, giving those words their customary and ordinary meaning as understood by one of ordinary skill in the art. I then must consider the patent specification to determine whether the inventor used any terms or words in a manner inconsistent with their plain and ordinary meaning. In addition to the claims and the specification, I also must review the prosecution history, which is the complete record of all the proceedings before the United States Patent and Trademark Office. This is because a patent applicant might have affirmatively, or by implication, limited claim scope during prosecution.

15. If the intrinsic evidence is not conclusive, I understand I may consider extrinsic evidence to ensure that a claim construction is not inconsistent with clearly expressed and widely held understandings in the pertinent technical field. Such extrinsic evidence may take the form of expert and/or inventor testimony, dictionaries, technical treatises, and articles. I further understand that I may not rely on extrinsic evidence to contradict or vary the meaning of claims provided by the intrinsic record.

16. I further understand that the claims should be construed from the standpoint of a hypothetical person of ordinary skill in the art as of the invention date of the asserted patent. I understand that claim construction is a matter of law and will be determined by the Court.

17. Because I do not know the particular meaning that Samsung or other experts in the case may attribute to these same terms, I have not had a chance to address those proposed meanings. To the extent that Samsung or its experts posit such proposed meanings in the future, I reserve the right to respond to such assertions or to modify my opinions accordingly.

18. I understand that once the claims have been properly construed, infringement is determined by comparing the claims to the accused products. I also understand that one directly infringes a United States Patent when one makes, uses, offers to sell, or sells in the United States any Patented invention without permission from the Patent owner.

19. I understand that to establish infringement of a Patent claim, a Patentee must prove that every limitation set forth in the claim is found literally or by substantial equivalent in the accused device or instrumentality. A device may be found to infringe an apparatus claim if it is reasonably capable of satisfying the claim limitations, even if it is also capable of operating in non-infringing modes.

20. I understand that one test for determining equivalence is to determine whether the differences between the claimed limitation and the accused product are insubstantial at the time of the infringement. I understand that another test for determining equivalence is to examine whether at the time of the infringement the element used by the accused product performs substantially the same function, in substantially the same way, to achieve substantially the same result as the claim limitation at issue. I also understand that one indication of substantial equivalence is that those of ordinary skill in the art at the time of the infringement would have known of the interchangeability of the accused feature with the claimed feature.

21. I further understand that infringement of a method claim can be either direct or indirect. I understand that an indirect infringement occurs either through inducement, where a party induces another to engage in acts that constitute direct infringement, or through contributory infringement, where a party sells an article that is made for use in an infringement of the patent's claims or, put otherwise, is not a staple article of commerce that has substantial non-infringing uses.

22. I understand that an invention is "conceived" when the inventor forms in his or her mind a definite and permanent idea of the complete and operative invention, and that an idea is sufficiently definite when the inventor has a specific, settled idea, or a particular solution to the problem at hand, not just a general goal or prospective research plan. However, I understand that a finding of conception does not require perfection since conception is complete when the idea is defined in the inventor's mind such that only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation. I further understand that because it is a mental act, an inventor's oral testimony regarding conception must be corroborated by evidence which shows that the inventor disclosed to others her completed thought expressed in such clear terms as to enable those skilled in the art to make the invention. However, I understand that conception may be corroborated even if no single piece of evidence shows complete conception and that all of the evidence of record must be collectively evaluated in determining when the invention was conceived. I understand that an invention is reduced to practice when it is constructed in an embodiment that meets every element of the claim and that embodiment operates for its intended purposes but need not be in a commercially satisfactory stage of development.

V. U.S. PATENT NO. 7,663,607 (MULTIPONT TOUCHSCREEN)

23. For the reasons set out below, it is my opinion that at least the sale, offer for sale, use, and/or importation in the United States of the Samsung Galaxy Tab 7.0 and Samsung Galaxy Tab 10.1 devices infringe claims 1-3, 6-8 and 10 and the Samsung Galaxy Tab 10.1 devices also infringe claim 11 of the '607 Patent.

24. The '607 Patent, entitled "Multipoint Touchscreen," names Steve Hotelling, Joshua Strickon, and Brian Huppi as inventors and is assigned to Apple, Inc. The '607 Patent issued on February 16, 2010. The Patent application leading to the '607 Patent was filed on May 6, 2004.

A. Person of Ordinary Skill in the Art

25. If called to testify at trial on the topic of the definition of a person of ordinary skill in the art for the '607 Patent, I expect to testify regarding the skill, education, and experience that

a person of ordinary skill in the relevant art would have had at the time of the invention of the ’607 Patent. In my opinion, the relevant art involves multipoint touchscreens. In my opinion and as submitted by Apple in a January 19, 2012 Joint Statement (ECF No. 650), a person of ordinary skill in the relevant art of the ’607 Patent at the time of the invention would have a Bachelor’s degree in electrical engineering, physics, computer engineering, or an equivalent, and two or more years of experience working with input devices.

B. Priority Date of Inventions

26. I intend to rely upon the documentary evidence and testimony of one or more of the named co-inventors of the ’607 Patent or other witnesses to testify regarding facts relevant to the conception and reduction to practice of the claimed invention prior to the filing date of the Patent.

27. In this case, I have reviewed the documentary evidence regarding the design work done on the inventions claimed in the ’607 Patent, including engineering drawings and inventor notebooks. [redacted]

C. Background of the Invention

28. The ’607 Patent discloses an elegant touch-screen solution for electronic devices, particularly graphics-based mobile or hand-held devices that have high-resolution displays and require human interaction.

29. As more fully developed below, the claimed inventions of the ’607 Patent relate to a specific configuration of conductive lines and layers that make up the touch panel in a display arrangement. The’607 Patent claims recite an innovative combination of elements including the use of a mutual capacitance touch screen in a truly transparent display that can simultaneously detect and generate signals representing distinct multiple points of actual or near contact and the use of “dummy” visual features (that can be made of the same material as the conductive lines in the display) to enhance the display.

D. Detailed Analysis of ’607 Patent Claims: Infringement/Embodiment

30. I have compared the elements recited in claims 1-3, 6-8, 10 and 11 of the ’607 Patent (“the asserted claims of the ’607 Patent”) to Apple’s iPad and iPhone products and to Samsung’s Galaxy Tab 7.0 and Galaxy Tab 10.1. The analysis below provides my opinions concerning whether the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 products infringe the claims and whether the Apple iPad and iPhone products embody the claims. My infringement views are supplemented by Exhibit E hereto (the claim chart presented as Exhibit 17 to Apple’s Infringement Contentions). The infringement evidence illustrated below is exemplary and not exhaustive, and may be supplemented based upon new evidence produced by Samsung or others, including any experts who may present reports or testify in this action.

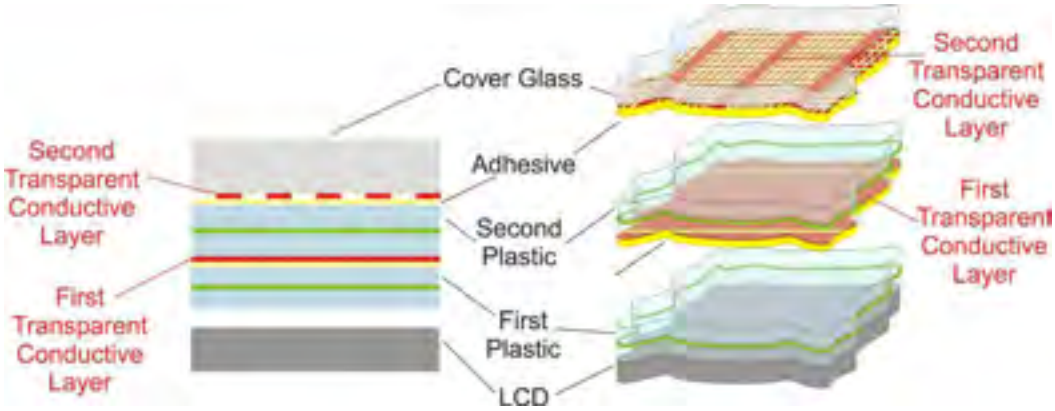
31. In my opinion, Samsung’s Galaxy Tab 7.0 and Galaxy Tab 10.1 literally infringe the asserted claims of the ’607 Patent and the iPad and iPhone products embody the asserted claims of the ’607 Patent.

2. Claim 1 Preamble: "A touch panel comprising a transparent capacitive sensing medium configured to detect multiple touches or near touches that occur at a same time and at distinct locations in a plane of the touch panel and to produce distinct signals representative of a location of the touches on the plane of the touch panel for each of the multiple touches, wherein the transparent capacitive sensing medium comprises"

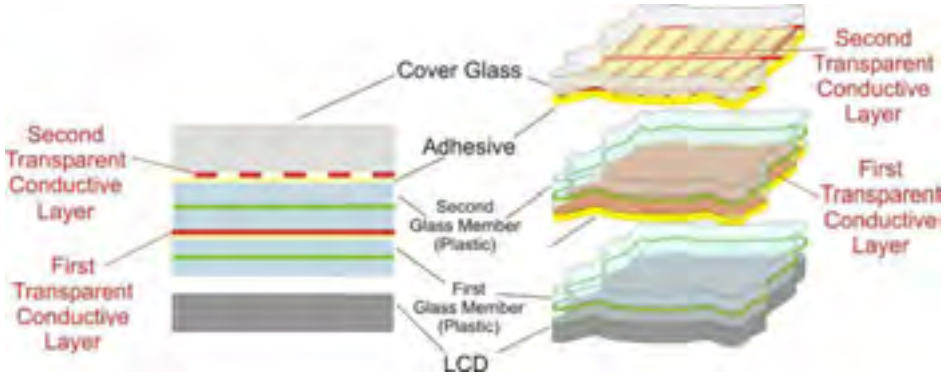
32. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone products sold in the U.S. and the iPad and iPad 2 products sold in the U.S. and reviewed documents relating to their operation including, for example, [redacted] I conclude that the Apple iPhones and the Apple iPad and iPad 2 products meet this limitation because they include a "touch panel" that includes "a transparent capacitive sensing medium" of mutual-capacitive drive and sense electrodes that are "configured to detect multiple touches or near touches that occur at a same time and at distinct locations in a plane of the touch panel," and "produce distinct signals representative of a location of the touches on the plane of the touch panel for each of the multiple touches." The text of the remainder of this claim describes first and second conductive lines running transversely and from which can be detected "charge coupling between" the lines. In conjunction with that claim language, the requirement of detecting "multiple touches or near touches that occur at a same time" and to produce distinct signals representative of a location of the touches on the plane of the touch panel," means that the claimed "touch panel" (and the Apple products embodying claimed "touch panel") can detect and locate multiple touches even when the touches are along a single sense line, and can smoothly track the motion of multiple fingers. As is evident from their smooth and accurate identification of multiple fingers in multiple-finger gestures, all of the Apple products I examined do this.

33. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 10.1 contains a 10.1" TFT LCD touchscreen. This is

described and shown in Samsung Galaxy Tab 10.1 Android Tablet User Manual ("Tab 10.1 User Manual"). APLNDC-Y0000060363-543 at APLNDC-Y0000060376. The Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. This is described and shown in the Samsung Galaxy Tab User 7.0 Manual ("Tab User 7.0 Manual"). APLNDC-Y0000063862-4011 at APLNDC-Y0000063879. The touchscreen in each includes two separate sets of conductive traces (labeled First Transparent Conductive Layer and Second Transparent Conductive Layer, in red below).



Galaxy Tab 10.1 stack



Galaxy Tab 7.0 stack

Figure. *Schematic representation of a* ***Samsung Galaxy Tab 10.1*** *(top) and* ***Galaxy Tab 7.0*** *(bottom) touchpanel in cross-section (left) and isometric assembly view (right). See also, SAMNDCA00324077; SAMNDCA00030975-977; SAMNDCA000324088-093. For clarity, the two thin polymer layers present directly below the touch glass in the* ***Samsung Galaxy Tab 7.0*** *(see Samsung Galaxy Tab 7.0 SEM, two figures below) have been drawn as part of the cover glass (top right figure).*

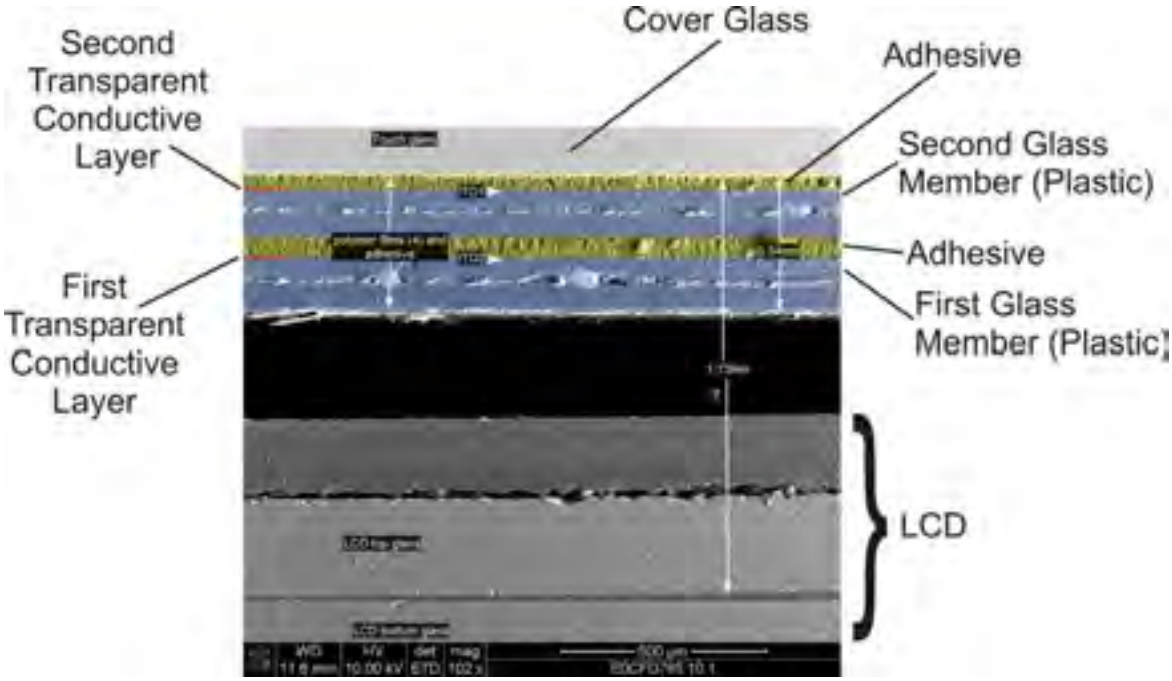


Figure. *Scanning Electron Micrograph of a cross-section through the* ***Samsung Galaxy Tab 10.1*** *touchscreen and display showing the various layers detailed in the schematic illustrations, above. The plane of the First and Second Transparent Conductive Layers are indicated by a dashed red line (and the label 'ITO'). See Exhibit C-32.*

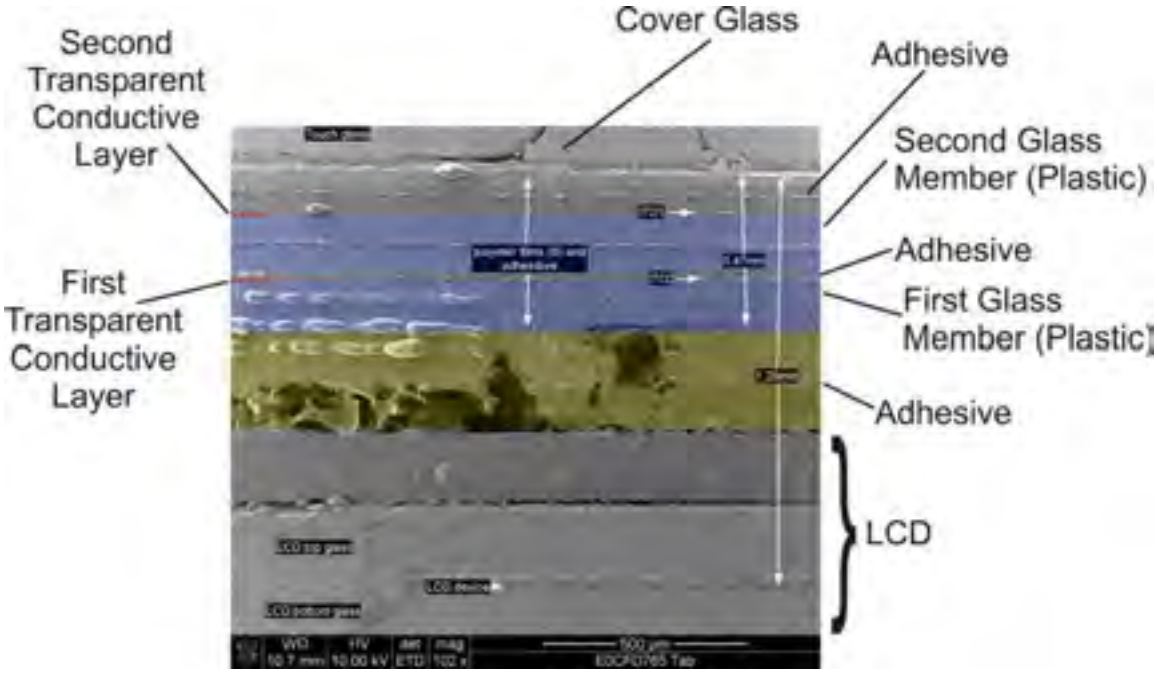
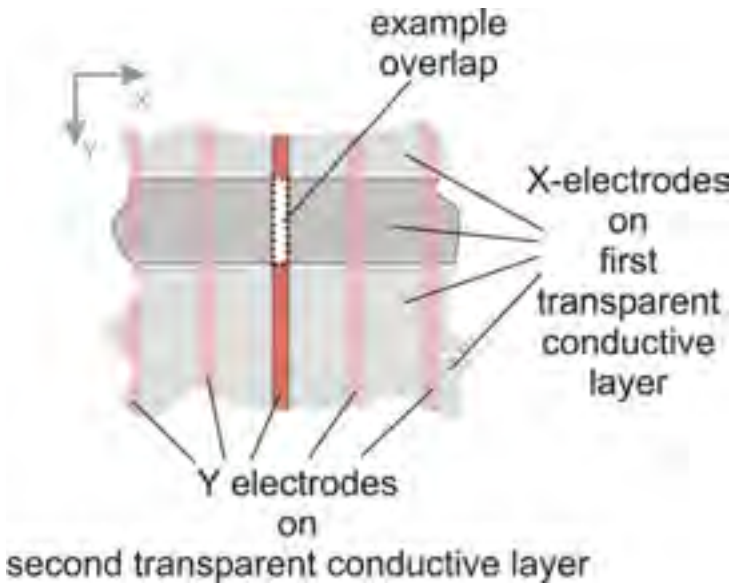
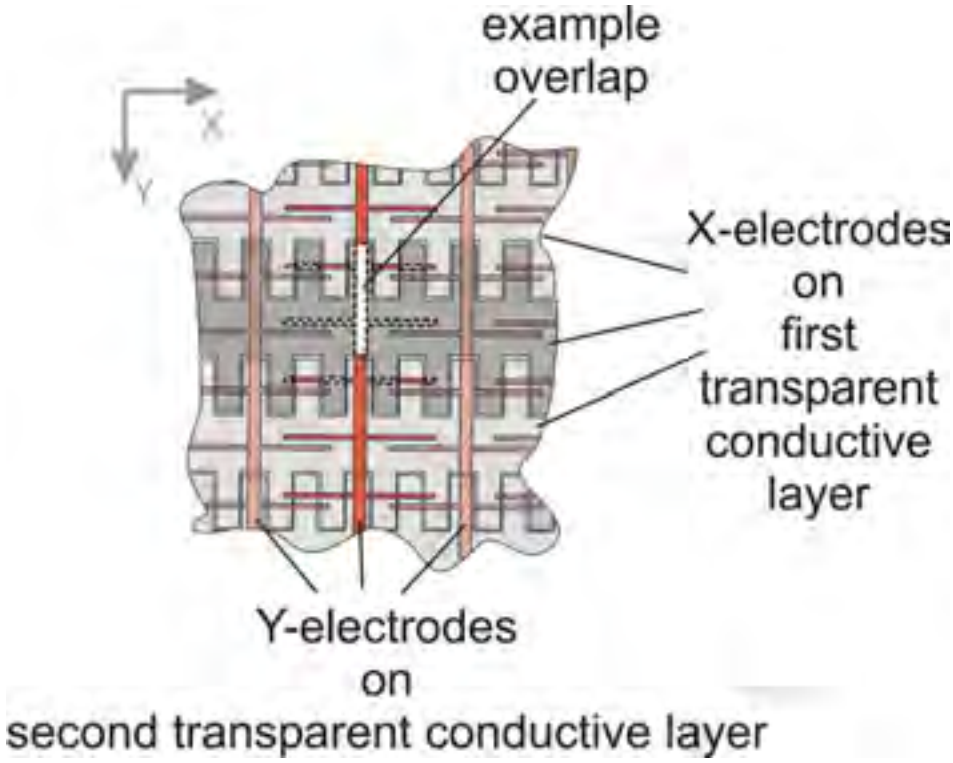


Figure. *Scanning Electron Micrograph of a cross-section through the* ***Samsung Galaxy Tab 7.0*** *touchscreen and display showing the various layers detailed in the schematic illustrations above. The plane of the First and Second Transparent Conductive Layers are indicated by a dashed red line (and the label 'ITO'). See Exhibit D-27.*

34. The touchscreen senses touches by detecting changes in the capacitive coupling that occurs at points where the electrodes on the First Transparent Conductive Layer overlap with electrodes on the Second Transparent Conductive Layer. I have illustrated this below for both the **Samsung Galaxy Tab 10.1** (first figure below) and the **Samsung Galaxy Tab 7.0** (second figure below). The principle of operation is the same for both (touches change the capacitance coupling at overlap points between electrodes on the first layer and second layers).



Figures. *Above is a schematic view of a portion of a* ***Samsung Galaxy Tab 10.1*** *touchscreen as seen from above. Below is a schematic view of a portion of a* ***Samsung Galaxy Tab 7.0*** *touchscreen as seen from above. In each, the electrodes on the First and Second Transparent Conductive Layers are on different layers; any overlap points (such as the example highlighted in white) form points of mutual capacitance between an electrode on the first layer and an electrode on the second layer. The square dummy regions on the Second Conductive Layer of the Galaxy Tab 10.1 are omitted for clarity.*



35. The Samsung Galaxy Tab 10.1 and Galaxy Tab 7.0 touchscreens are configured to detect multiple touches and to produce distinct signals representative of a location of the touches on the plane of the touch panel for each of the multiple touches, which enables true multi-touch operations by the user. This is evident both from the User Manuals provided with the Samsung Galaxy Tab 7.0 and the Samsung Galaxy Tab 10.1 and from the documentation of the Atmel controllers used to operate the Samsung Galaxy Tab 7.0 and Samsung Galaxy Tab 10.1 touchscreens. In the first case, I have provided an example from the Samsung Galaxy Tab 10.1 and Galaxy Tab 7.0 Android Tablet Manuals, which clearly shows instructions referring to multitouch touchscreen functions such as “pinch” and “zoom”:

Screen Navigation

Touch

Touch items to select or launch them. For example:

- Touch the on-screen keyboard to enter characters or text.
- Touch a menu item to select it.
- Touch an application's icon to launch the application.

Touch and Hold

Activate on-screen items. For example:

- Touch and hold a widget on the home screen to move it.
- Touch and hold on a field to display a pop-up menu of options.

Swipe, Flick, or Slide

Swipe, flick, or slide your finger vertically or horizontally across the screen. For example:

- Unlocking the screen
- Scrolling the Home screens or a menu

Pinch

Use two fingers, such as your index finger and thumb, to make an inward pinch motion on the screen, as if you are picking something up, or an outward motion by sweeping your fingers out. For example:

- Pinch a photo in Gallery to zoom in.
- Pinch a webpage to zoom in or out.

Figure. *Tab 10.1 User Manual (APLNDC-Y0000060382). See also, APLNDC-Y0000065908-6056 at APLNDC-Y00006599; APLNDC-Y0000063862-64011 at APLNDC-Y0000063885.*

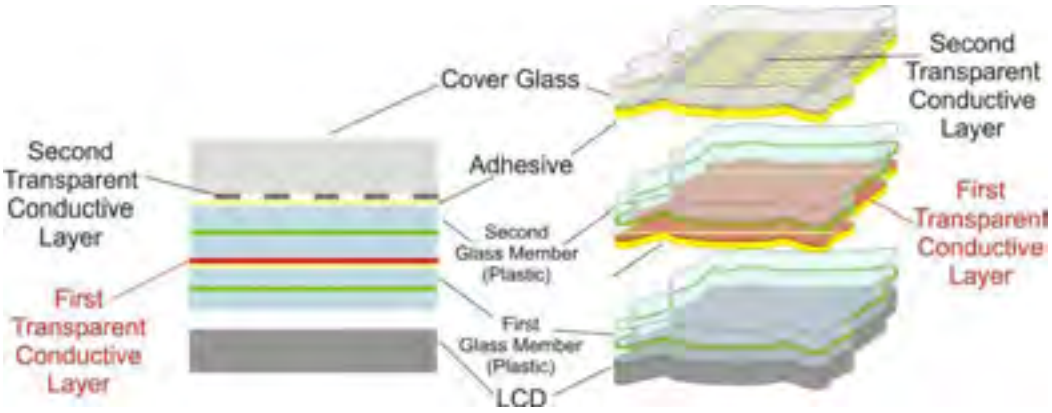
36. In the second case, the Samsung Galaxy Tab 7.0 senses touchscreen touches with Atmel mXT224 controllers. The Atmel mxt224 Datasheet (ATMEL-HTC00000374-419 at ATMEL-HTC00000382.) clearly shows the controllers allow the "measurement of up to 224 mutual capacitance nodes. . . ." Moreover, it states: True 12-bit multitouch with independent XY tracking for up to 10 concurrent touches in real time with touch size reporting. (ATMEL-HTC00000374.) Likewise, the Samsung Galaxy Tab 10.1 uses the Atmel mXT1386/mXT154 controllers to sense touches. From Samsung's Approval Sheet for the Atmel mXT1386/mXT154 (SAMNDCA00298652): "The mXT1386, together with its three associated mxT154 slave devices, is part of the maXTouch™ family of touchscreen controllers" which allow the "measurement of up to 1386 mutual-capacitance channels…". The Atmel mXT1386 website (http://www.atmel.com/devices/mxt1386.aspx, accessed 18 March 2012) likewise states that the

mXT1386 "features multi-touch performance, enabling touches to be identified and individually tracked…". (APLNDC-Y0000234084-086 at APLNDC-Y0000234085.)

3. "a first layer having a plurality of transparent first conductive lines that are electrically isolated from one another;"

37. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because they have "a first layer having a plurality of transparent first conductive lines that are electrically isolated from one another." The first electrode layer contains lines that are made of a transparent conductive material (Indium Tin Oxide or "ITO") and are electrically isolated from each other via etch gaps.

38. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 include a transparent capacitive sensing medium that comprises a first electrode layer (labeled First Transparent Conductive Layer, in red, below) having a plurality of transparent conductive lines that are electrically isolated from one another, as shown below.



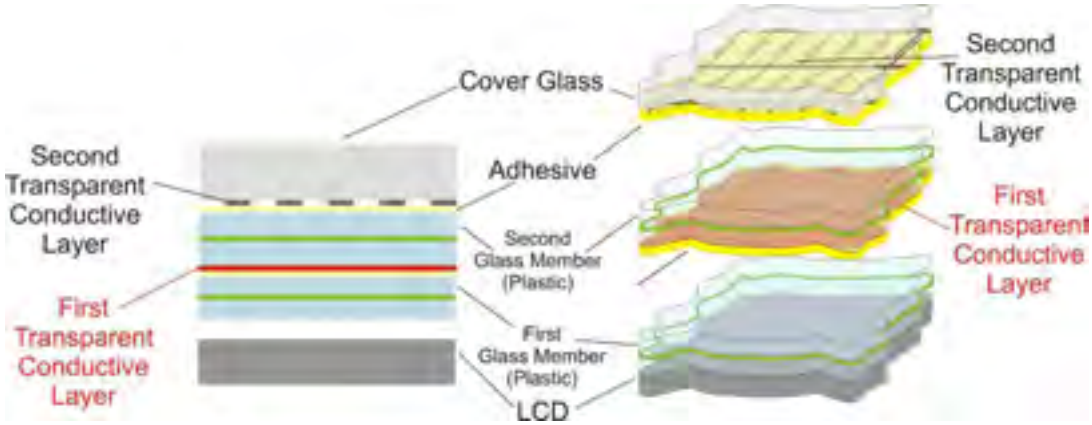


Figure. *Schematic representation of a* ***Samsung Galaxy Tab 10.1*** *(top) and* ***Galaxy Tab 7.0*** *(bottom) touch panels in cross-section (left) and isometric assembly view (right).*

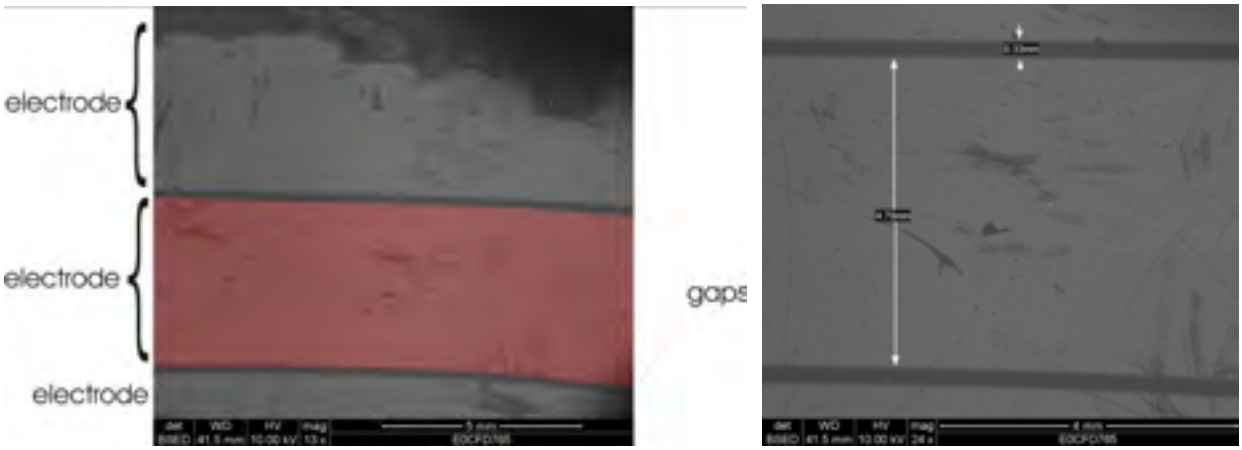


Figure. *Scanning Electron Micrographs (SEM) of the First Transparent Conductive Layer in a Galaxy Tab 10.1. The images are identical; one electrode is highlighted in red in the left image. Dimensions are provided in the right image. See Exhibit C-48 and Exhibit C-50.*

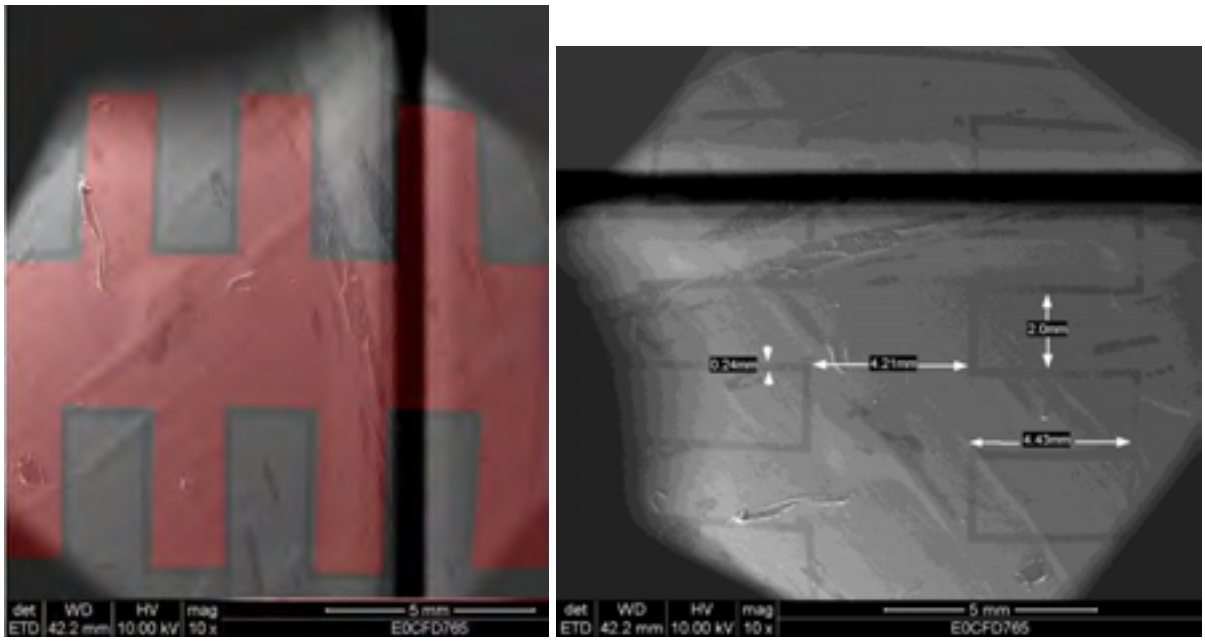


Figure. *Scanning Electron Micrograph (SEM) of the First Transparent Conductive Layer in a Galaxy Tab 7.0. The images are identical; one electrode is highlighted in red in the left image. Dimensions are provided in the right image. See Exhibit D-11 and D-12.*

This first electrode layer contains lines that are made of a transparent conductive material and are electrically isolated from each other via etch gaps. Conductivity was established via two point measurements. Additionally, X-ray photoelectron spectroscopy (XPS) indicates that the first electrode material is indium tin oxide (ITO), a transparent conductor material; XPS spectra is provided below.

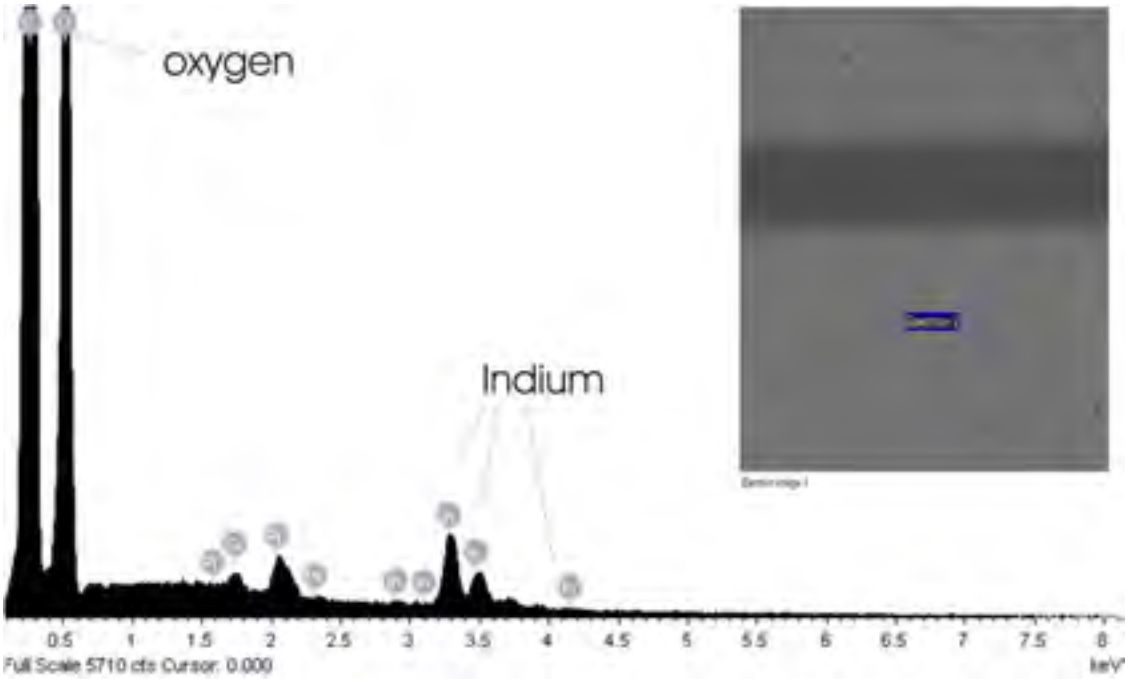


Figure. *Labeled XPS spectra for Galaxy Tab 10.1 showing the presence of indium and oxygen in the material of the First Transparent Conductive Layer. See Exhibit C-26. Peaks appearing in the spectra at different locations along the x-axis correspond to different elements present in the sample. These spectra clearly show the presence of indium and oxygen, indicating that the material is ITO. For each figure, the physical location on the trace where the XPS analysis was done is indicated in the grey inset SEM image (top right inset)with a purple rectangle.*

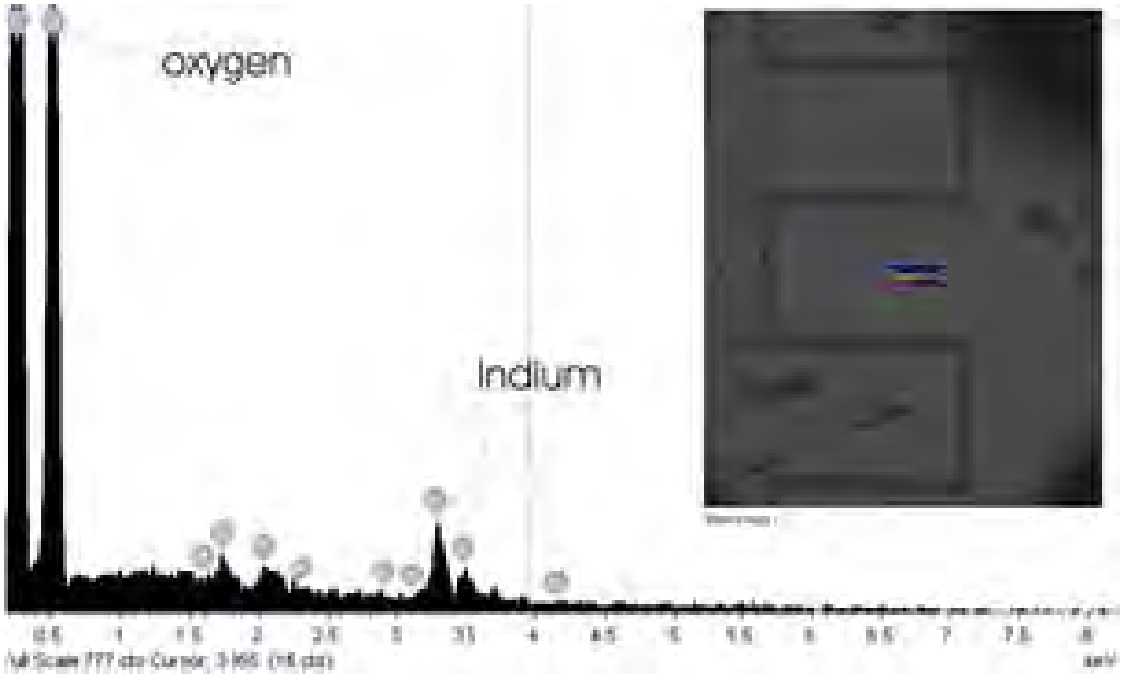


Figure. *Labeled XPS spectra for Galaxy Tab 7.0 showing the presence of indium and oxygen in the material of the First Transparent Conductive Layer. Peaks appearing in the spectra at different locations along the x-axis correspond to different elements present in the sample. These spectra clearly show the presence of indium and oxygen, indicating that the material is ITO. For each figure, the physical location on the trace where the XPS analysis was done is indicated in the grey inset SEM image (top right inset)with a purple rectangle. See also Exhibit D-22.*

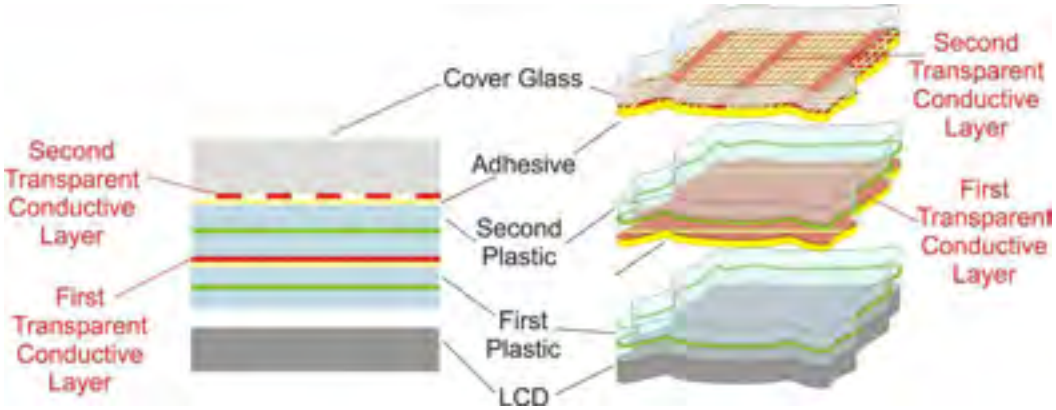
39. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices satisfy the limitation of "a first layer having a plurality of transparent first conductive lines that are electrically isolated from one another" in Claim 1.

4. "and a second layer spatially separated from the first layer and having a plurality of transparent second conductive lines that are electrically isolated from one another, the second conductive lines being positioned transverse to the first conductive lines, the intersection of transverse lines being positioned at different locations in the plane of the touch panel, each of the second conductive lines being operatively coupled to capacitive monitoring circuitry;"

40. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because they have "a second layer spatially separated from the first layer and having a plurality of transparent second conductive lines that are electrically isolated from one another, the second conductive lines being positioned transverse to the first conductive lines, the intersection of transverse lines being positioned at different locations in the plane of the touch panel, each of the second conductive lines being operatively coupled to capacitive monitoring circuitry." Each of the Apple products I examined included a second layer of ITO separated spatially from the first layer of ITO and the second layer are conductive lines that are

electrically isolated from one another and positioned to run transversely to the first layer of ITO conductive lines and that are coupled to sensing circuitry to monitor capacitive coupling of, for example, a finger on the touch sensor. The required monitoring circuitry I discuss in the next claim limitation below.

41. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 include a second electrode layer (labeled Second Transparent Conductive Layer, in red, below) spatially separated from the first electrode layer (labeled First Transparent Conductive Layer, in red, below) and having a plurality of transparent second conductive lines that are electrically isolated from one another. (The required monitoring circuitry I discuss in the next limitation below.) As illustrated in the cross-section images above and the schematic reconstruction below, the Galaxy Tab 7.0 and Galaxy Tab 10.1 include first and second layers that contain transparent conductive lines and are spatially separated from each other by a plastic layer.



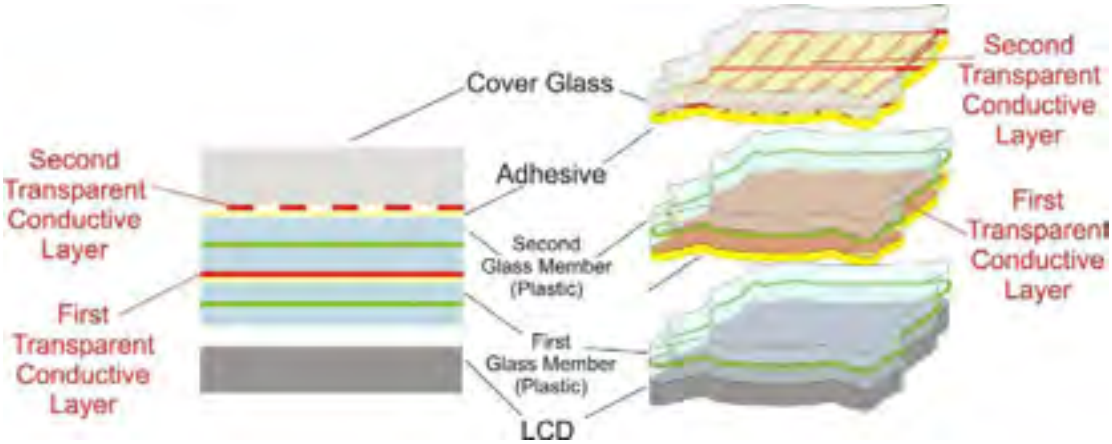
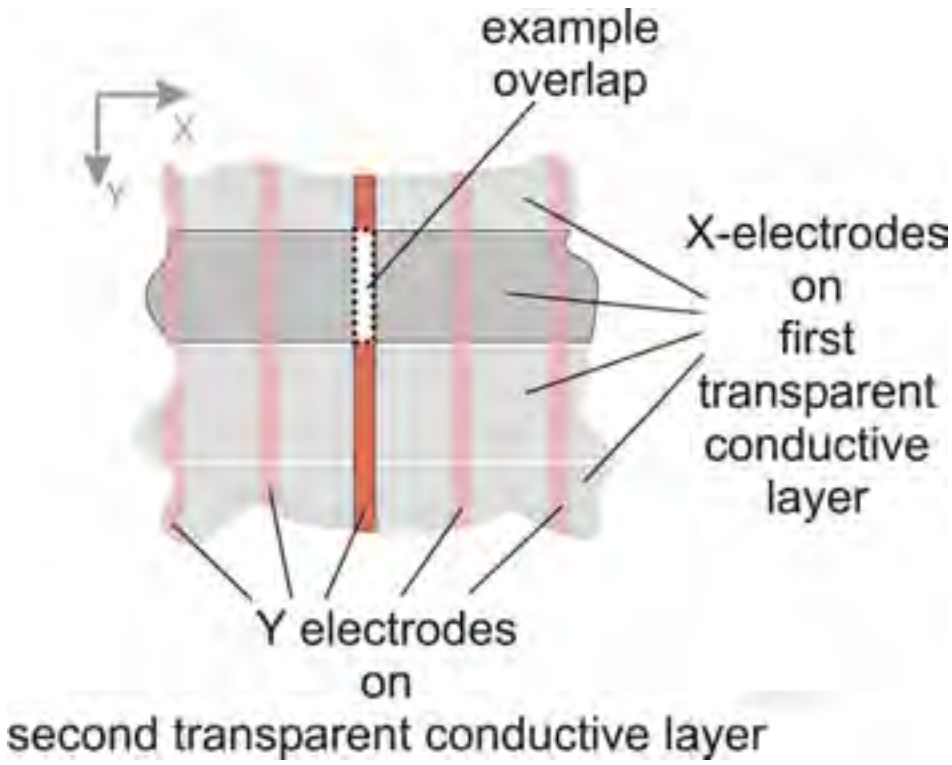
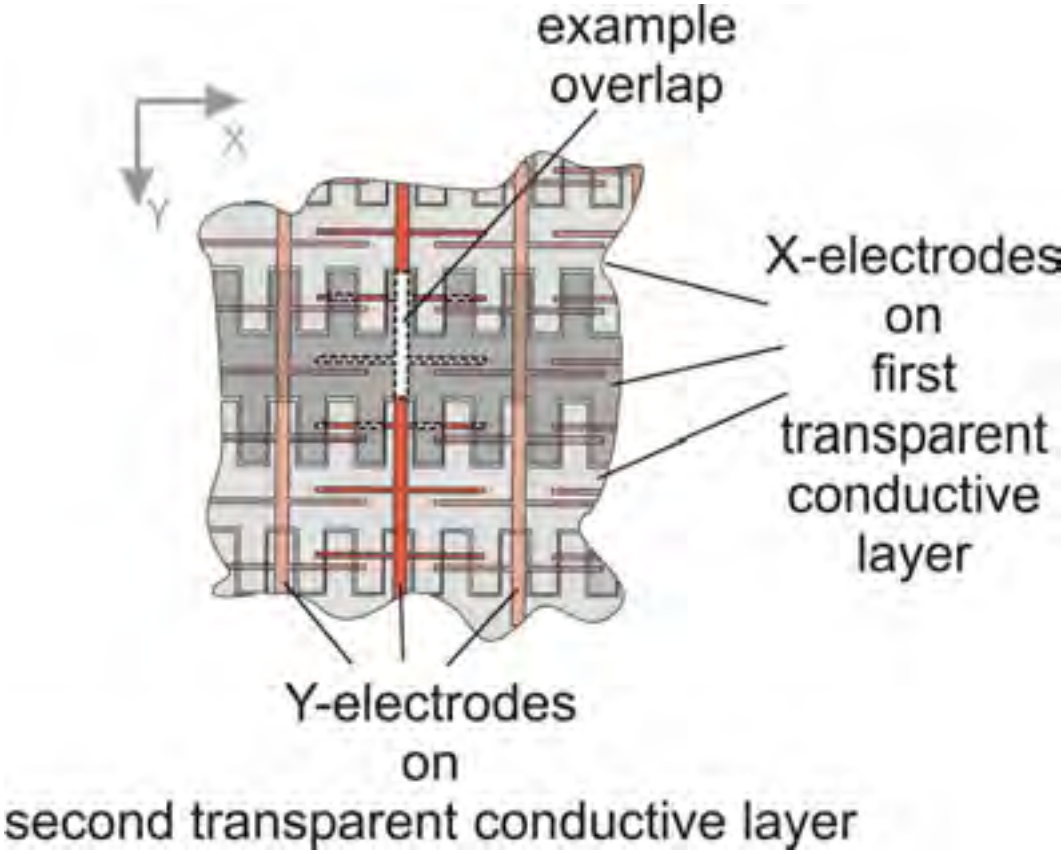


Figure. *Schematic representation of a* ***Samsung Galaxy Tab 10.1*** *(top) and a* ***Samsung Galaxy Tab 7.0*** *(bottom) touchpanel in cross-section (left) and isometric assembly view (right).*



Figures. *Above is a schematic view of a portion of a* ***Samsung Galaxy Tab 10.1*** *touchscreen as seen from above. Below is a schematic view of a portion of a* ***Samsung Galaxy Tab 7.0*** *touchscreen as seen from above. In each, the electrodes on the First and Second Transparent Conductive Layers are on different layers; any overlap points (such as the example highlighted in white) form points of mutual capacitance between an electrode on the first layer and an electrode on the second layer. The square dummy regions on the Second Conductive Layer of the Galaxy Tab 10.1 are omitted for clarity.*



42. **The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 include a second electrode** layer (labeled Second Transparent Conductive Layer, in red, above) spatially separated from the first electrode layer (Second Transparent Conductive Layer, in red, above) and having a plurality of transparent second conductive lines *which are transverse* to the first conductive lines (see Figures below). When the first conductive lines are positioned in the horizontal direction, the second conductive lines are positioned in the vertical direction, as illustrated in the side-by-side micrographs of the first and second electrode layers below. In this configuration, the intersection of transverse lines are clearly positioned at different locations in the plane of the touch panel, as shown in the schematic reconstruction above.

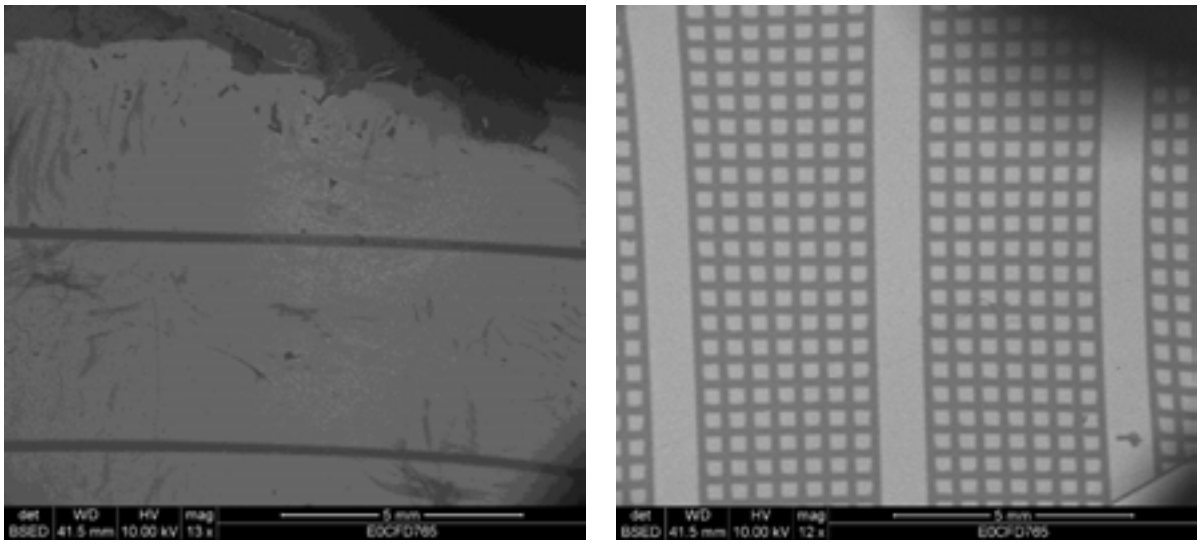


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the First Conductive Layer (left) and the Second Conductive Layer (right) in the* ***Samsung Galaxy Tab 10.1*** *aligned along the X-Y plane as they are within the touchscreen. See Exhibit C-48 and Exhibit C-15. Note how the conductive lines on the Second Conductive Layer are positioned transverse to the lines on the Second Conductive Layer. Note also that the Second Conductive Layer's transparent conductive lines are electrically isolated from one another by an etch gap and by dummy (electrically isolated) regions, which are not electrically connected to each other or to other electrodes. The presence of the etch gap and the dummy regions electrically isolates the conducting lines on the Second Conductive Layer from each other.*

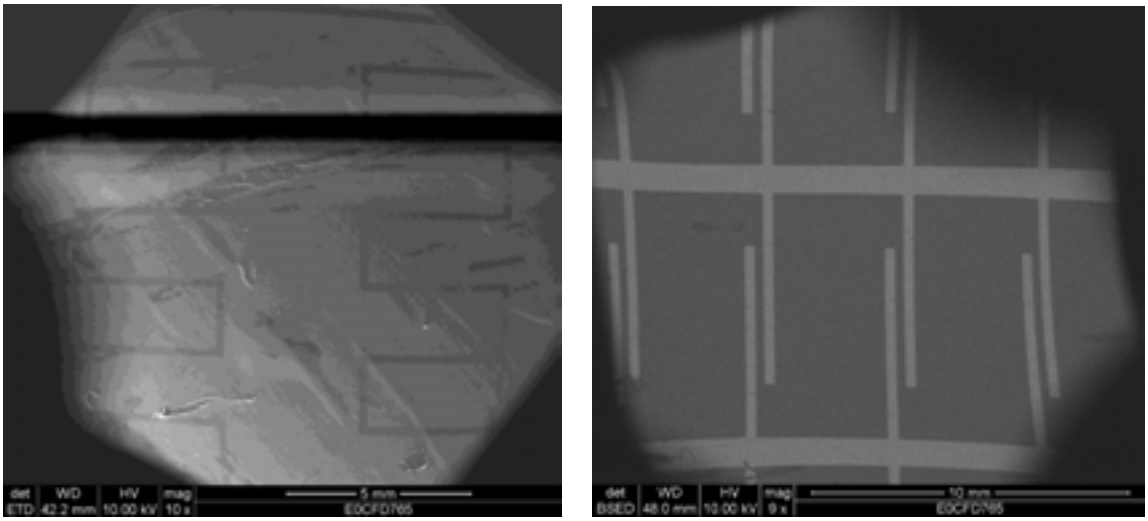


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the First Conductive Layer (left) and the Second Conductive Layer (right) in the* ***Samsung Galaxy Tab 7.0*** *aligned along the X-Y plane as they are within the touchscreen. See Exhibit D-11 and Exhibit D-15. Note how the conductive lines on the Second Conductive Layer are positioned transverse to the lines on the Second Conductive Layer. Note also that the Second Conductive Layer's transparent conductive lines are electrically isolated from one another by an etch gap. The presence of the etch gap electrically isolates the conducting lines on the Second Conductive Layer from each other.*

5. "wherein the capacitive monitoring circuitry is configured to detect changes in charge coupling between the first conductive lines and the second conductive lines."

43. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because "the capacitive monitoring circuitry is configured to detect changes in charge coupling between the first conductive lines and the second conductive lines." Indeed, all of the Apple iPhones and iPad and iPad 2 products I examined operate on the principle of mutual capacitance in which the sense circuits detect charge coupling between the sense and drive lines.

44. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 device include "monitoring circuitry" in a touch screen panel integrated circuit that is "configured to detect changes in charge coupling between the first conductive lines and the second conductive lines" in Claim 1. As shown above, the touchscreen in the Samsung Galaxy Tab 10.1 is a mutual capacitance

touchscreen, which includes two sets of spatially separated traces, oriented transverse to each other. As set forth above, one set of conductive lines are connected to the capacitive monitoring circuitry. When a current is driven through elements on the other set of lines, the capacitive monitoring circuitry can detect changes in charge coupling between the first and second set of conductive lines when an object is on or near the touchscreen.

45. The Galaxy Tab 7.0 employs the Atmel mxt224 touchscreen controller to monitor capacitance changes. According to the Atmel website, the Atmel mxt224 is part of the maXTouch family of controllers (http://www.atmel.com/devices/mxt224.aspx ,accessed 14 March 2012) (APLNDC-Y0000234088–89 at APLNDC-Y0000234088.). Additionally, the mxt224 is "A 224-node highly configurable touchscreen controller that is part of the Atmel maXTouch product platform. An optimal and scalable architecture enables smart processing of a capacitive touch image to accurately regenerate and report the user's interaction with the touchscreen. Multi-touch performance identifies and individually tracks touches and allows a range of built-in gestures . . . ." *(Id.)*

46. The Galaxy Tab 10.1 employs the Atmel mxt1386 and mxt154 touchscreen controller set to monitor capacitance changes. According to the Atmel website, the Atmel mxt1386/mxt154 set is part of the maXTouch family of controllers (http://www.atmel.com/devices/mxt1386.aspx ,accessed 14 March 2012) (APLNDC-Y0000234084-086 at APLNDC-Y0000234085.). Additionally, the mxt1386 is "A 1386-node multi-chip solution (4-chips) which is part of the Atmel maXTouch™ product platform. By combining charge transfer and powerful 32-bit AVR microcontroller technology, this high performance architecture enables unlimited touch up to 16 touches, fast response time at over 150Hz, and smart processing of a capacitive touch image to accurately regenerate and report user interaction with the touchscreen. By supporting grip suppression and palm rejection, the screen enables unconstrained usage and intuitive user experience. The device features multi-touch performance, enabling touches to be identified and individually tracked and allowing a range of built-in gestures . . . ." *(Id.)* Indeed, all of the accused devices of Samsung I examined detected

touches or near touches using mutual capacitance detection circuitry. ATMEL-HTC00000374-419 at ATMEL-HTC00000382; ATMEL-SAMSUNG00001188-199; SAMNDCA00298652.

47. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 1 of the ’607 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad and iPad 2 products meet the limitations, they embody the invention of this claim.

6. Claim 2: “The touch panel as recited in claim 1 wherein the conductive lines on each of the layers are substantially parallel to one another.”

48. I have spoken to the named-inventors of the ’607 Patent claims who were working on designs for Apple’s products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted]. I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because in each “the conductive lines on each of the layers are substantially parallel to one another.”

49. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 7.0 has conductive lines on each of the layers that are substantially parallel to one another as shown by the images below.

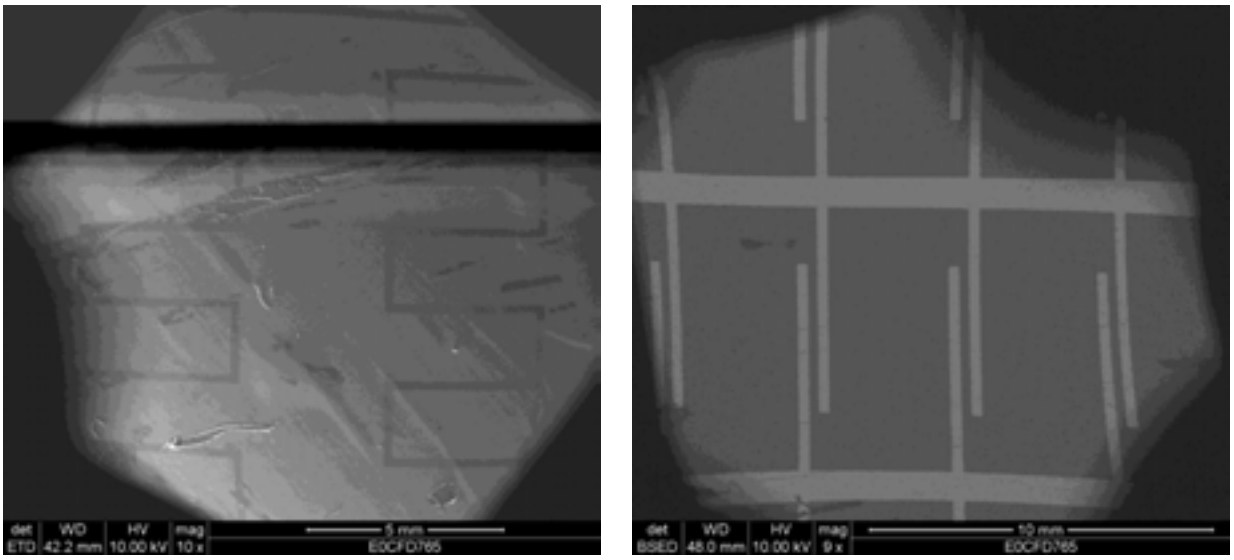


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the First Conductive Layer (left) and the Second Conductive Layer (right) in the* ***Samsung Galaxy Tab 7.0*** *aligned along the X-Y plane as they are within the touchscreen. See Exhibit D-11 and Exhibit D-15. Note how the conducting lines on the First Conductive Layer are parallel to each other (left). Conductive lines on the Second Conductive Layer are also parallel to each other (and separated by etch gaps).*

50. The Samsung Galaxy Tab 10.1 has conductive lines on each of the layers that are substantially parallel to one another as shown by the images below.

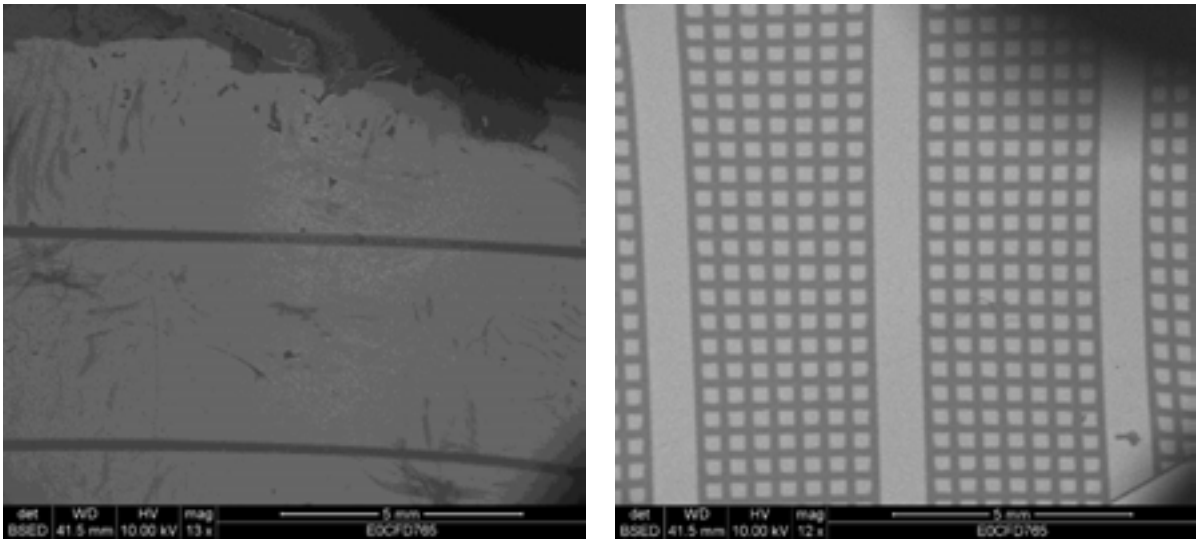


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the First Conductive Layer (left) and the Second Conductive Layer (right) in the* ***Samsung Galaxy Tab 10.1*** *aligned along the X-Y plane as they are within the touchscreen. See Exhibit C-48 and Exhibit C-15. Note how the conducting lines on the First Conductive Layer are parallel to each other (left). Conductive lines on the Second Conductive Layer are also parallel to each other (and separated by unconnected dummy regions).*

51. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 2 of the ’607 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad and iPad 2 products meet the limitations, they embody the invention of this claim.

7. Claim 3: “The touch panel as recited in claim 2 wherein the conductive lines on different layers are substantially perpendicular to one another.”

52. I have spoken to the named-inventors of the ’607 Patent claims who were working on designs for Apple’s products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because “the conductive lines on different layers are substantially perpendicular to one another” in those products. Indeed, the conductive sense and drive lines in the Apple products run vertically and horizontally in the touch sensor.

53. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 contain conductive lines on the

first and second layers of the touch panel which are oriented substantially along the X and Y axes, respectively, of a Cartesian grid and are therefore substantially perpendicular to one another, as illustrated in the side-by-side scanning electron micrographs (SEM) of the first and second conductive layers below.

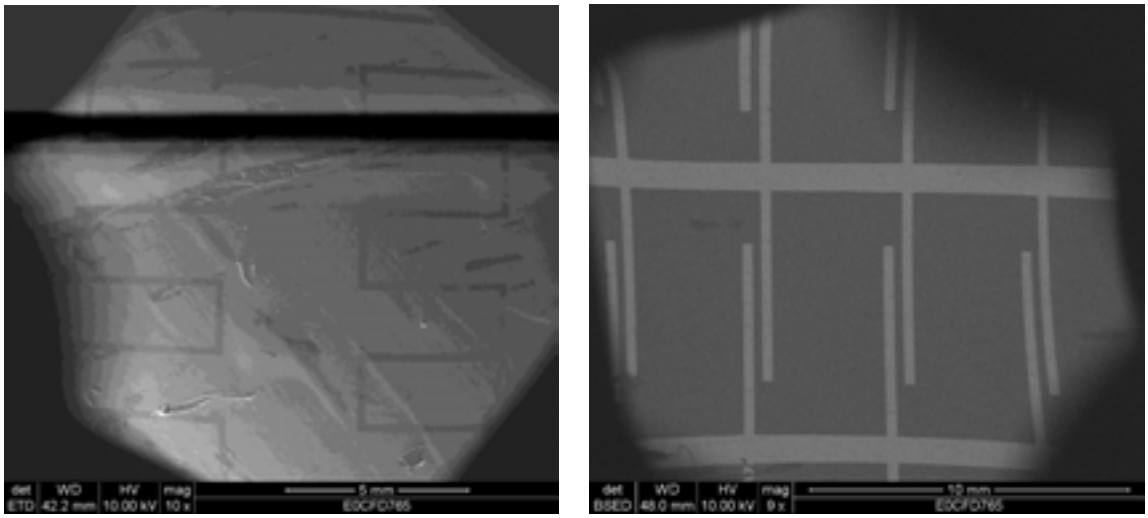


Figure. *Side by side comparison (Samsung Galaxy Tab 7.0) of Scanning Electron Micrographs (SEM) of the First Conductive Layer (left) and the Second Conductive Layer (right) in the* ***Samsung Galaxy Tab 7.0*** *aligned along the X-Y plane as they are within the touchscreen. See Exhibit D-11 and Exhibit D-15. Note how the conductive lines on the First Conductive Layer are positioned perpendicular to the lines on the Second Conductive Layer.*

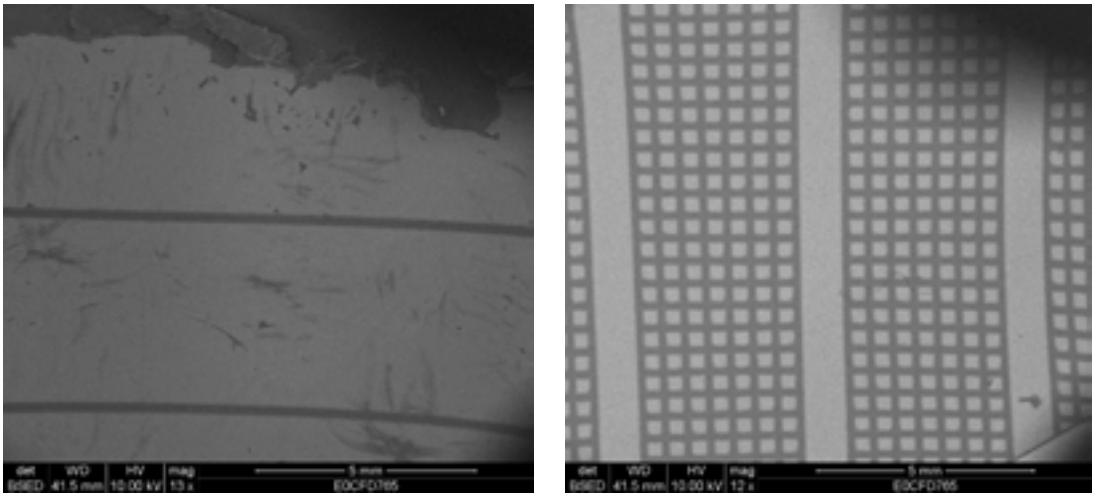


Figure. *Side by side comparison (Samsung Galaxy Tab 10.1) of Scanning Electron Micrographs (SEM) of the First Conductive Layer (left) and the Second Conductive Layer (right) in the* ***Samsung Galaxy Tab 10.1*** *aligned along the X-Y plane as they are within the touchscreen. See Exhibit C-48 and Exhibit C-15. Note how the conductive lines on the First Conductive Layer are positioned perpendicular to the lines on the Second Conductive Layer.*

54. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 3 of the ’607 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad and iPad 2 products meet the limitations, they embody the invention of this claim.

8. Claim 6: “The touch panel as recited in claim 1 wherein the conductive lines are formed from indium tin oxide (ITO).”

55. I have spoken to the named-inventors of the ’607 Patent claims who were working on designs for Apple’s products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted]. I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because “the conductive lines are formed from indium tin oxide (ITO).”

56. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. In each of those devices, the first and second transparent conductive layers contain lines that are made of a transparent conductive material. X-ray photoelectron spectroscopy

(XPS) indicates that this electrode material is indium tin oxide (ITO), a transparent conductor material; XPS spectra is provided below.

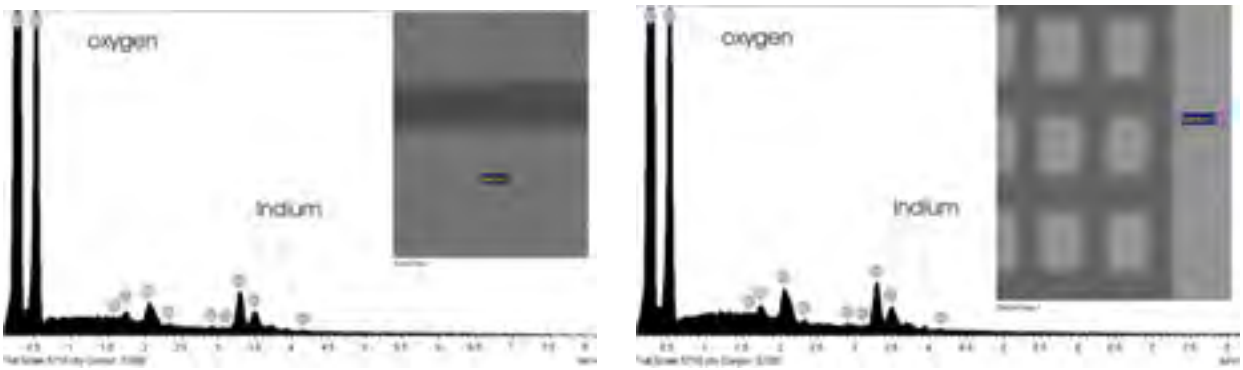


Figure. *Labeled XPS spectra of the first (left) and second (right) conductive layers in the* ***Samsung Galaxy Tab 10. 1.*** *See Exhibit C-26 and Exhibit C-24. Peaks appearing in the spectra at different locations along the x-axis correspond to different elements present in the sample. These spectra clearly show the presence of indium and oxygen, indicating that the material is ITO. For each figure, the physical location on the trace where the XPS analysis was done is indicated in the grey inset SEM image (top right inset)with a purple rectangle.*

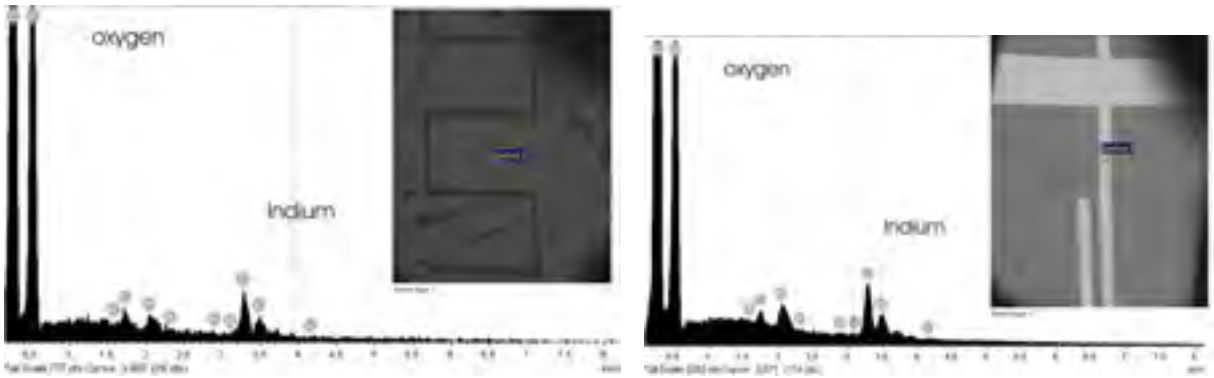


Figure. *Labeled XPS spectra of the first (left) and second (right) conductive layers in the* ***Samsung Galaxy Tab 7.0.*** *See Exhibit D-22 and Exhibit D-20. Peaks appearing in the spectra at different locations along the x-axis correspond to different elements present in the sample. These spectra clearly show the presence of indium and oxygen, indicating that the material is ITO. For each figure, the physical location on the trace where the XPS analysis was done is indicated in the grey inset SEM image (top right inset)with a purple rectangle.*

57. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 6 of the ’607 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad and iPad 2 products meet the limitations, they embody the invention of this claim.

9. Claim 7: “The touch panel as recited in claim 1, wherein the capacitive sensing medium is a mutual capacitance sensing medium.”

58. I have spoken to the named-inventors of the ’607 Patent claims who were working on designs for Apple’s products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted]. I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because “the capacitive sensing medium” in each “is a mutual capacitance sensing medium.” As noted above, all of the Apple products I examined use mutual capacitance as the sensing method.

59. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The touch panels in the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 are clearly a mutual capacitance sensing medium. Specifically, the touch panel includes two sets of conductive lines separated by a non-conductive layer and oriented transverse to each other so as to create a 2D array of overlap points between the first and second electrode layers. The conductive electrodes on the first electrode layer are connected to capacitive monitoring circuitry. During operation, when a current is driven through the electrodes on the first electrode layer, the

capacitive monitoring circuitry can detect changes in capacitive coupling between electrodes on the first and second layers when an object is on or near the touchscreen.

60. The Samsung Galaxy Tab 7.0 senses touchscreen touches with Atmel mXT224 controllers. [redacted]

61. Likewise, the Samsung Galaxy Tab 10.1 uses the Atmel mXT1386/mXT154 controllers to sense touches. From Samsung's Approval Sheet for the Atmel mXT1386/mXT154 (SAMNDCA00298652): "The mXT1386, together with its three associated mxT154 slave devices, is part of the maXTouch™ family of touchscreen controllers" which allow the "measurement of up to 1386 mutual capacitance channels…"(emphasis added).

62. [redacted]

63. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 7 of the '607 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad and iPad 2 products meet the limitations, they embody the invention of this claim.

10. Claim 8: "The touch panel as recited in claim 7, further comprising a virtual ground charge amplifier coupled to the touch panel for detecting the touches on the touch panel."

64. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted]

[redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because "touch panel" in each "includes a virtual ground charge amplifier coupled to the touch panel for detecting the touches on the touch panel." I have confirmed this by examining the circuits in the Apple products.

65. As described in the Specification of the '607 Patent (column 17, lines 48-49, for example) and in Figures 12 and 13 of the '607 Patent, the 'virtual ground charge amplifier' is one part of a "front end" to be connected directly between the touchscreen sense lines and any capacitive sensing circuitry (for example, as shown in item 230 in Figure 12 of the '607 Patent). At column 17, lines 36-45 and as shown in Figure 12, the '607 Patent teaches that "The sensing line 224 may contain a <u>filter</u> 236 for eliminating parasitic capacitance 237, … Generally speaking, the filter rejects stray capacitance effects so that a clean representation of the charge transferred across the node 226 is outputted (and not anything in addition to that). That is, the filter 236 produces an output that is not dependent on the parasitic capacitance, but rather 45 on the capacitance at the node 226." [emphasis added].

66. The '607 Patent specification also makes clear (at column 17, lines 47-50, for example): "FIG. 13 is a diagram of an inverting amplifier 240, in accordance <u>with one embodiment</u> of the present invention. The inverting amplifier 240 <u>may generally correspond to the filter 236 shown in FIG. 12</u>." [emphasis added]. The circuit in Figure 13 can appropriately be described as a "virtual ground charge amplifier." Specifically, the circuit in Figure 13 is a current integrator. Consider a current, *i*, traveling into the inverting terminal of the amplifier (labeled 'IN' in Figure 13) from a touchscreen capacitive sensor node. Note that **1)** node IN is a 'virtual ground' (because the inverting terminal is grounded and the amplifier contains a negative feedback loop) and **2)** virtually all of the incoming current must travel through the capacitor in Figure 13 (because of the amplifier's very large input impedance), **3)** the current through the capacitor in Figure 13 must obey

$$i_C = C\frac{dv_C}{dt}$$

it is clear that

$$\frac{dV_{OUT}}{dt} = -\frac{dv_C}{dt} = -\frac{i_C}{C}$$

thus

$$V_{OUT} = \frac{-1}{C}\int i_C\,dt$$

The voltage on the OUT node in Figure 13 thus provides the time integral of the current into the input node.

67. Unfortunately, I understand that despite a subpoena requesting these relevant materials, no detailed circuit schematics have yet been provided for any of the Atmel capacitance monitoring IC's (specifically, the Atmel mxt224 used in the Samsung Galaxy Tab 7.0 and the Atmel mxt1386/154 set used in the Samsung Galaxy 10.1). [redacted].

68. [redacted]

69. [redacted]

70. [redacted]

71. I understand that specific circuit schematics and other information are forthcoming from Atmel and I reserve the right to supplement my opinions on this subject after I review those materials.

11. Claim 10 Preamble: "A display arrangement"

72. I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because they obviously include "A display arrangement." Similarly, the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices include a "display arrangement." It is self-evident from using them or from the depiction below that each of these devices includes a display that the user looks at during use. Consequently, all of these devices meet the limitations of the preamble.

Figure. *From left to right: iPhone, iPhone 3G, iPhone 3GS, iPhone 4, and iPod Touch (above). From left to right: iPad and iPad 2 (below). Photos are not to scale.*

12. "a display having a screen for displaying a graphical user interface;"

73. I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because they include "a display having a screen for displaying a graphical user interface." The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. As is self-evident from using them or from the depiction above, each of these devices has a graphical user interface that is presented on the screen of the display.

13. "and a transparent touch panel allowing the screen to be viewed therethrough and capable of recognizing multiple touch events that occur at different locations on the touch panel at a same time and to output this information to a host device to form a pixilated image;"

74. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted]

[redacted]. I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because they each have a "transparent touch panel allowing the screen to be viewed therethrough and capable of recognizing multiple touch events that occur at different locations on the touch panel at a same time and to output this information to a host device to form a pixilated image." As noted above with respect to claim 1, each of these devices has a transparent touch screen through which the LCD display can be seen and that can detect multiple touch events at different locations at the same time (as when using multiple-finger gestures). In each case, the information is presented to the integrated circuit interpreting the touch events as a series of bit locations in memory representing positions on the screen. Consequently, each of these Apple devices meets these limitations.

75. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 include a transparent touch panel allowing the screen to be viewed therethrough and capable of recognizing multiple touch events that occur at different locations on the touch panel at a same time and to output this information to a host device to form a pixilated image. More specifically, these devices include a transparent touchscreen capable of accepting and detecting multiple simultaneous touches. For instance, the display is used to navigate and configured to detect multiple touches, such as using two fingers to "pinch" to zoom in or zoom out. (*See, e.g.*, Tab User 7.0 Manual (APLNDC-Y0000063885; APLNDC-Y000065999) and Tab 10.1 User Manual (APLNDC-Y0000060382).)

76. Moreover, the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 output information regarding touches on its touchscreen to a host device to form a pixilated image. Specifically, the touchscreen includes two sets of conductive lines separated by a non-conductive layer and oriented transverse to each other so as to create a 2D array of overlap points between the first and second electrode layers. Each of these overlap points, or nodes, constitutes a capacitive sensor.

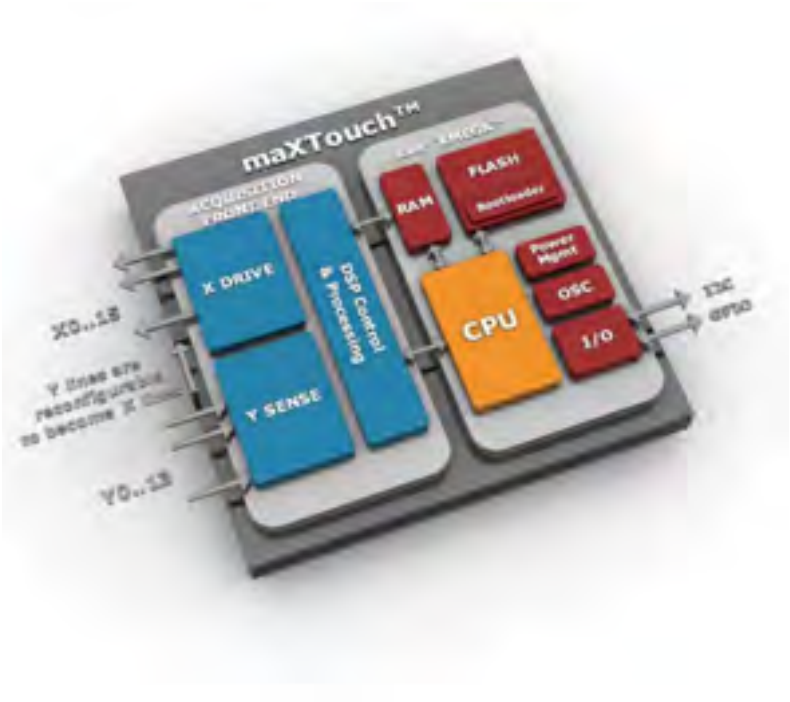


Figure. *Atmel graphic (SAMNDCA10280711, a better image of which is available at http://1.bp.blogspot.com/t8Z1nQGRx3g/TVyHGCOW6NI/AAAAAAAAAwk/mSnWOX0BmII/s400/Atmel_mXTouch_Block_diagram.jpg) showing Acquisition Front End processing of information from touch panel and passage of touch event image data to CPU host.*

77. As shown in the Figure above, for example, during one or multiple touches, the data from the drive and sense lines is processed by the Atmel controller Acquisition Front End and passed to the CPU host to form a pixelated image representing the one or more sensor locations touched on the touchscreen. (The Atmel touchscreen controller "[c]reates a capacitive 'image' of the panel which can be processed to reject palms or touches from the side." SAMNDCA10280704-736 at SAMNDCA10280711). [redacted] SAMNDCA00298652; http://www.atmel.com/devices/MXT1386.aspx (last accessed March 19) ("By combining charge transfer and powerful 32-bit AVR microcontroller technology, this high performance architecture enables unlimited touch up to 16 touches, fast response time at over 150Hz, and smart processing of a capacitive touch image to accurately regenerate and report user interaction with the touchscreen." (emphasis added)) (APLNDC-Y0000234084-086 at APLNDC-Y0000234085);

http://www.atmel.com/devices/MXT224.aspx (last accessed March 19, 2012) ("An optimal and scalable architecture enables smart processing of a capacitive touch image to accurately regenerate and report the user's interaction with the touchscreen." (emphasis added) (APLNDC-Y0000234088–89 at APLNDC-Y0000234088).

14. "wherein the touch panel includes a multipoint sensing arrangement configured to simultaneously detect and monitor the touch events and a change in capacitive coupling associated with those touch events at distinct points across the touch panel;"

78. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because "the touch panel includes a multipoint sensing arrangement configured to simultaneously detect and monitor the touch events and a change in capacitive coupling associated with those touch events at distinct points across the touch panel." As noted in the discussion of claim 1 above, each of these devices detects and monitors over time multiple simultaneous touch events by detecting the change in capacitive coupling in the touch screen caused by the presence of fingers, for example. This required capability of "recognizing multiple touch events that occur at different locations on the touch panel at a same time" and the required "multipoint sensing arrangement configured to simultaneously detect and monitor the touch events and a change in capacitive coupling associated with those touch events at distinct points across the touch panel" means that the claimed "touch panel" (and the Apple products embodying claimed "touch panel") can detect and locate multiple touches even when the touches are along a single sense line, and can smoothly track the motion of multiple fingers. As is evident from their

smooth and accurate identification of multiple fingers in multiple-finger gestures, all of the Apple products I examined do this.

79. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 each include a multipoint sensing arrangement configured to simultaneously detect and monitor touch events via changes in capacitive coupling associated with those touch events at distinct points across the touch panel. These devices permit multiple simultaneous touch inputs and accordingly include a sensing arrangement to detect and monitor touch events. (*See, e.g.*, Tab User 7.0 Manual (APLNDC-Y0000063885; APLNDC-Y000065999) and Tab 10.1 User Manual (APLNDC-Y0000060382).)

80. Further, the touchscreen of both the Samsung Galaxy Tab 7.0 and the Samsung Galaxy Tab 10.1 operate as a capacitive sensing medium to monitor the change in capacitive coupling associated with touch events. In particular, as illustrated in the schematic diagram below, the touchscreen includes two separate sets of conductive traces (labeled First Conductive Layer and Second Conductive Layer, in red, below), and senses touches through capacitive coupling between the two. This coupling occurs at the intersections between a first and a second conducting line at distinct points on the touch panel.

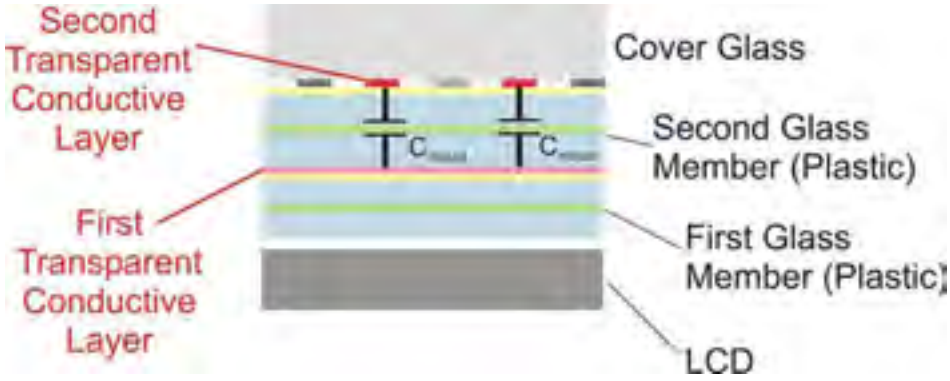
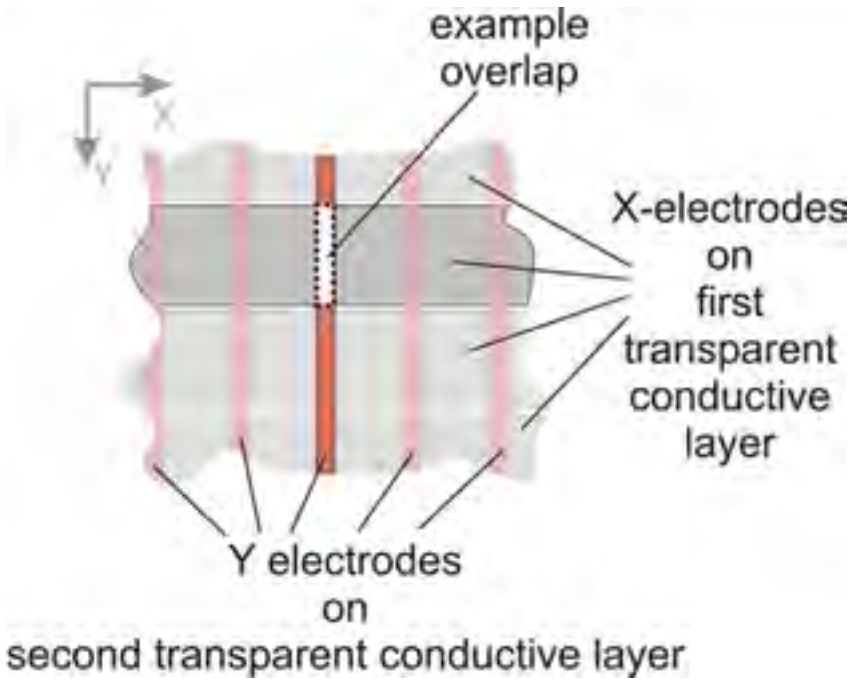
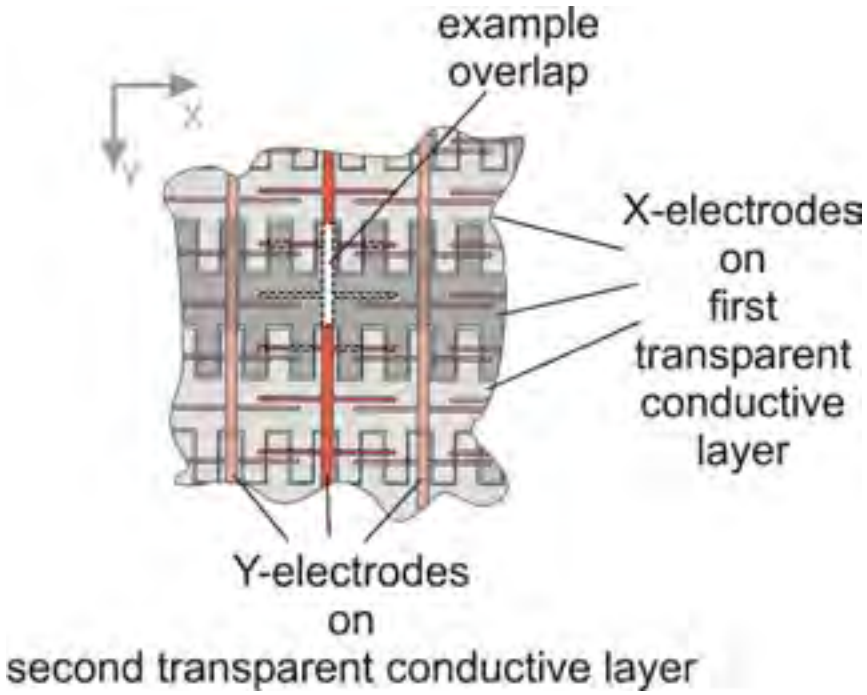


Figure. *Schematic representation of a* ***Samsung Galaxy Tab 7.0*** *and* ***Samsung Galaxy Tab 10.1*** *touchpanel in cross-section showing two example locations where the overlap between an electrode on the Second Conductive Layer and the First Conductive Layer result in capacitive coupling (each capacitor so formed is labeled* C_{mutual}*.)*



Figures. *Schematic representation of a* ***Samsung Galaxy Tab 10.1*** *touchpanel in top view (above) and a* ***Samsung Galaxy Tab 7.0*** *touchpanel in top view (below) showing one example location where the overlap between an electrode on the Second Conductive Layer and the First Conductive Layer result in capacitive coupling.*



15. "and wherein the touch panel comprises: a first glass member disposed over the screen of the display;"

81. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because in each "the touch panel comprises: a first glass member disposed over the screen of the display." For purposes of this analysis, I have applied the meaning of "glass member" as defined in the '607 Patent, in which the plastic or actual glass are used interchangeably, much like a "glass of water" is a "glass of water" even if the container is made of plastic or some other material. For example, the patent expressly states at column 16, lines 46-49, "any suitable glass or plastic material may be used for the glass members." This is just a self-evident short-hand phrasing that the inventors used and is not uncommon in every-day life. In each of the Apple products I examined, there is a first member of glass disposed over the screen of the display. In the event that "glass member" must literally be composed of just actual glass, I find that the use of other materials such as plastic is substantially equivalent to, interchangeable with, and would perform substantially the same function (not blocking or adversely affecting light and acting as a dielectric and insulator), in substantially the same way (permitting passage of the light and not electrically shorting conductive layers), to achieve substantially the same result (have minimal effect on the user's visual experience of the display) as chemically pure glass. Indeed, the '607 Patent at column 16, lines 46-49, expresses exactly that concept.

82. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 include a touch panel with a first

glass member disposed over the screen of the display. For instance, the first glass member disposed over the LCD (labeled LCD, in red, below) is a plastic layer (labeled First Glass Member, in red, below). (Here, "glass member" is understood to apply interchangeably to both plastic and glass substrates, as these substrates are functionally identical for the purposes of the claims).

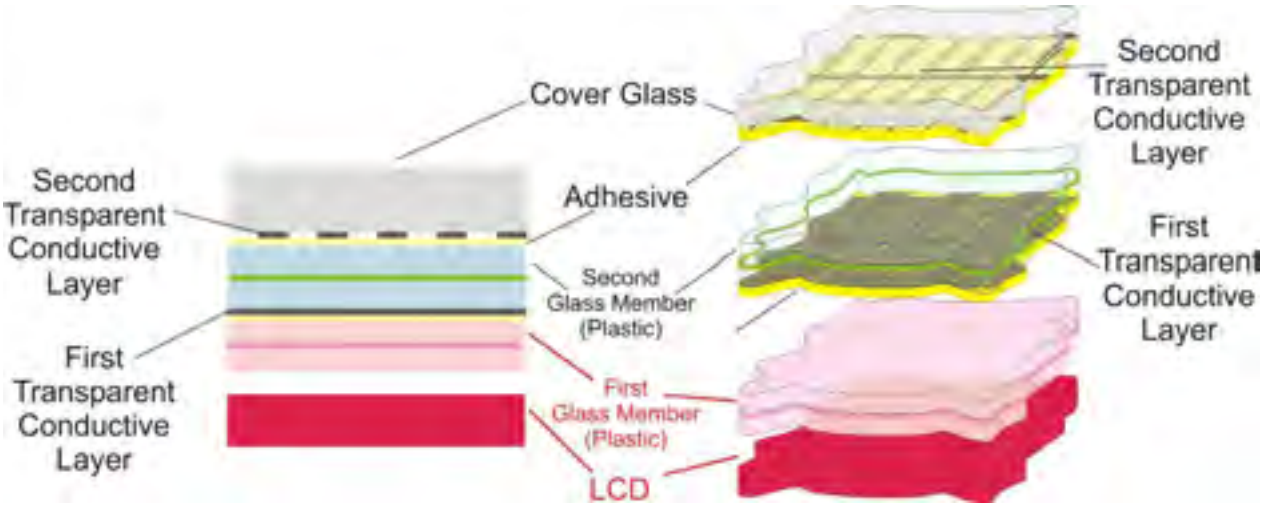


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in cross-section (left) and isometric assembly view (right) with First Glass Member and LCD display layer highlighted in pink and red.*

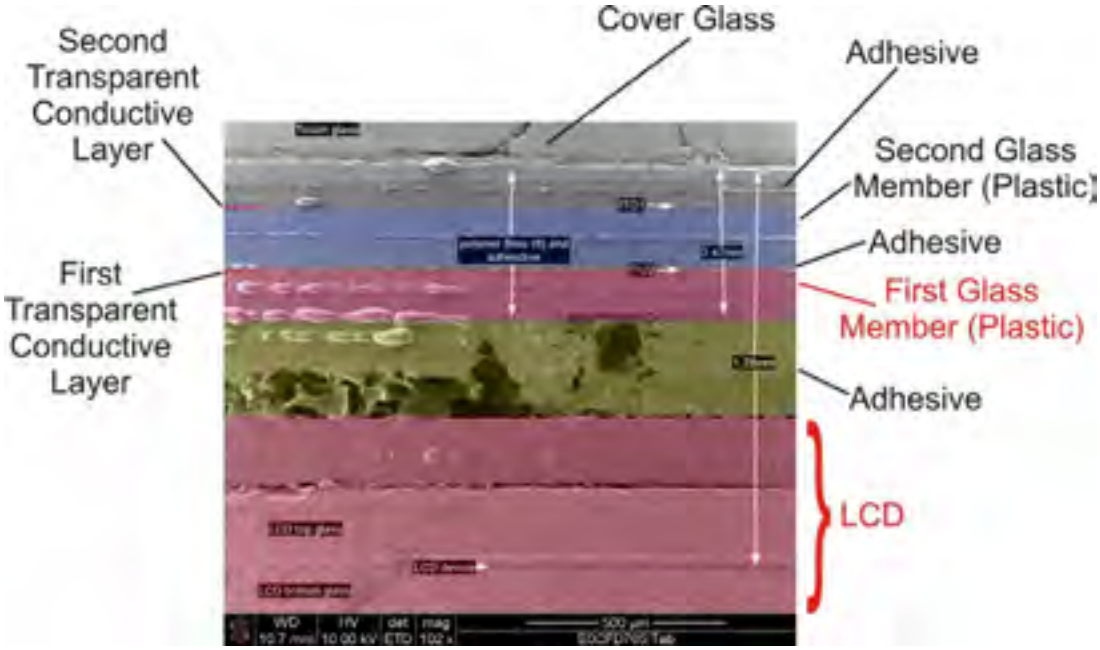


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing the various layers detailed in the schematic illustration, above. The First Glass Member and the LCD layer are highlighted in red. See Exhibit D-27.*

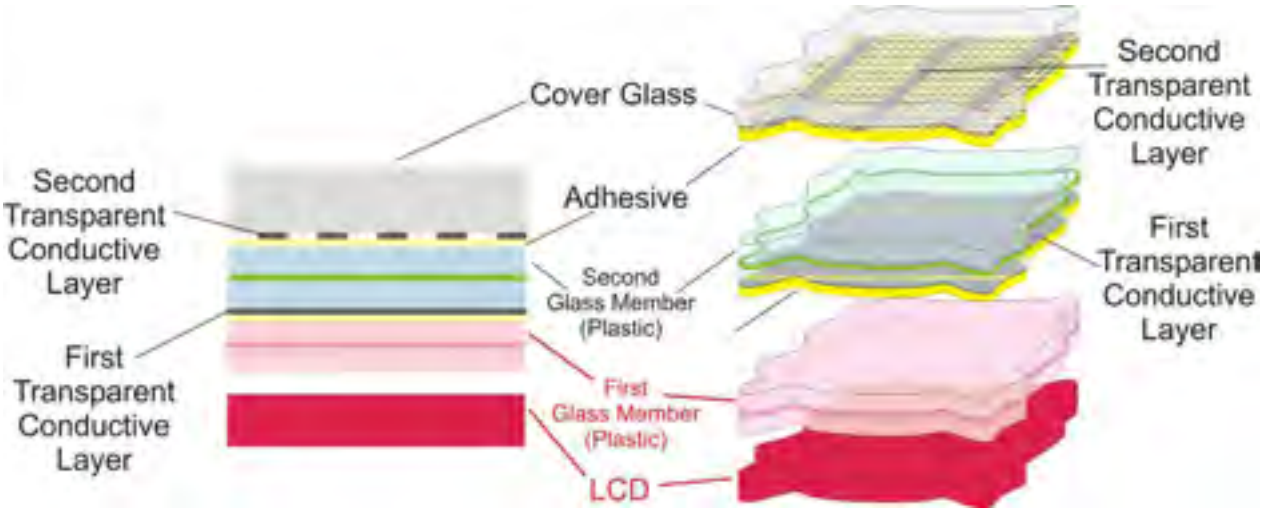


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touchpanel in cross-section (left) and isometric assembly view (right) with First Glass Member and LCD display layer highlighted in red.*

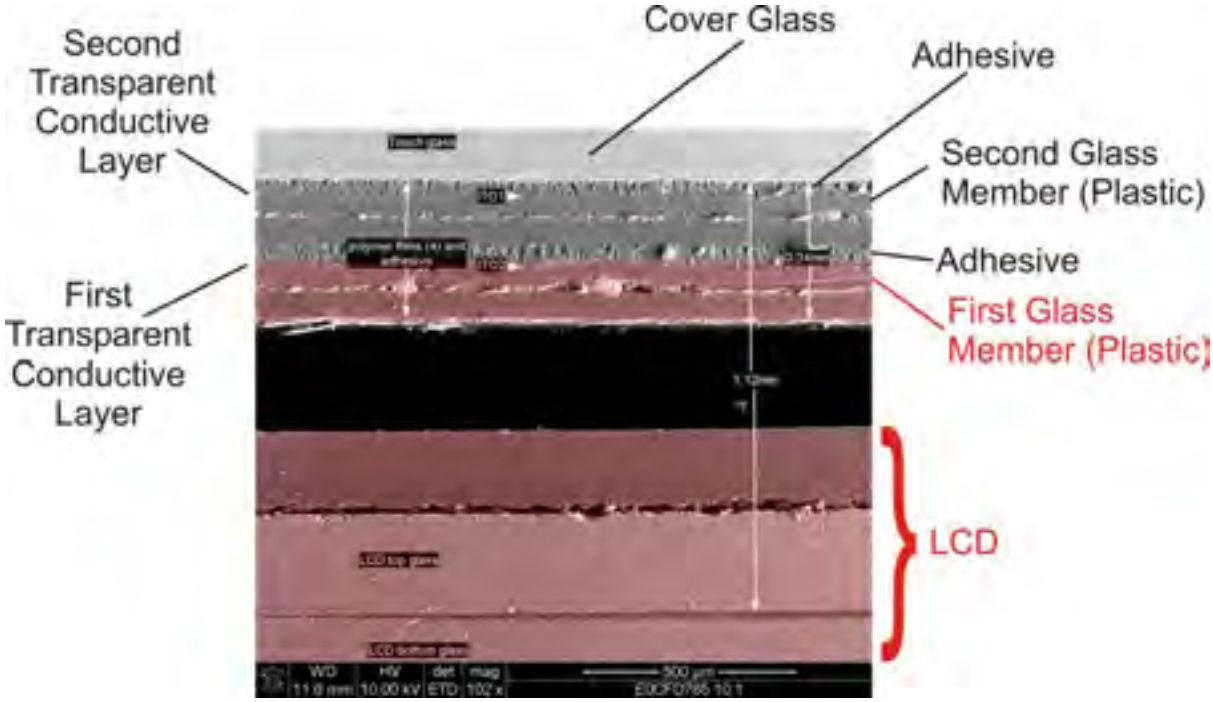


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing the various layers detailed in the schematic illustration, above. The First Glass Member and the LCD layer are highlighted in red. See Exhibit C-32.*

83. For purposes of this analysis, I have applied the meaning of "glass member" as defined in the '607 Patent, in which the plastic or actual glass are used interchangeably, much like a "glass of water" is a "glass of water" even if the container is made of plastic or some other material. For example, the patent expressly states at column 16, lines 46-49, "any suitable glass or plastic material may be used for the glass members." This is just a self-evident short-hand phrasing that the inventors used and is not uncommon in every-day life. In each of the Apple products I examined, there is a first member of glass disposed over the screen of the display. In the event that "glass member" must literally be composed of just actual glass, I find that the use of other materials such as plastic is substantially equivalent to, interchangeable with, and would perform substantially the same function (not blocking or adversely affecting light and acting as a dielectric and insulator), in substantially the same way (permitting passage of the light and not electrically shorting conductive layers), to achieve substantially the same result (have minimal effect on the user's visual experience of the display) as chemically pure glass. Indeed, the '607 Patent at column 16, lines 46-49, expresses exactly that concept.

84. Note also that for purposes of this analysis, I have applied the meaning of "member" to be a unit that is not necessarily comprised of a single layer or a single substance. Much like a piece of plywood is a "wood member," even though it is a composite unit of many materials and layers, the patent makes no distinction or restriction with respect to the content of a "member." Here I conclude that the "member" at issue may be comprised of two layers of plastic glued (or "taped" together). Samsung treats this unit of layers as a single "member" – it has its own single unique part number and it is purchased as a single sheet from a supplier and then added to the device as a single member. (SAMNDCA00324077; SAMNDCA00298802 at 819, 840, and 926; SAMNDCA00299040 at 062, 065, 066.) Thus, I conclude that the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meet this limitation because in each of the Samsung products I examined, there is a "first glass member."

85. In the event that "glass member" must be only a single layer of a single material, I conclude that such a composite member is substantially equivalent to, interchangeable with, and would perform substantially the same function (not blocking or adversely affecting light and acting as a dielectric and insulator), in substantially the same way (permitting passage of the light and not electrically shorting conductive layers), to achieve substantially the same result (have minimal effect on the user's visual experience of the display) as a single-layer "glass member." At most, a multi-layer member may be chosen for ease of manufacture or shipment prior to manufacture. Such differences are irrelevant to the purpose of the claimed feature.

16. "a first transparent conductive layer disposed over the first glass member, the first transparent conductive layer comprising a plurality of spaced apart parallel lines having the same pitch and linewidths;".

86. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted]. I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because they include "a first transparent conductive layer disposed over the first glass member, the first transparent conductive layer comprising a plurality of spaced apart parallel lines having the same pitch and linewidths." As noted above, the Apple products include a layer of transparent ITO as a conductive layer. That layer is disposed over the "first glass member," in each of the devices and is made up of spaced apart parallel lines with common pitch and linewidths.

87. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 10.1 includes a touch panel with a first transparent conductive layer (labeled First Transparent Conductive Layer, in red, below) disposed over a first glass member (labeled First Glass Member, in pink, below). More specifically, the first

transparent conductive layer is the layer of conductive traces on Second Transparent Conductive Layer, which is disposed over the plastic just above the LCD.

88. The first transparent conductive layer comprises a plurality of spaced apart lines having the same pitch and linewidths. In particular, the first transparent conductive layer is comprised of a plurality of parallel lines having a line width of approximately 4.78 mm with a 0.33 mm gap resulting in a pitch (defined as the center to center spacing of the parallel lines on the first transparent conductive layer) of approximately 5.1 - 5.2 mm**.**

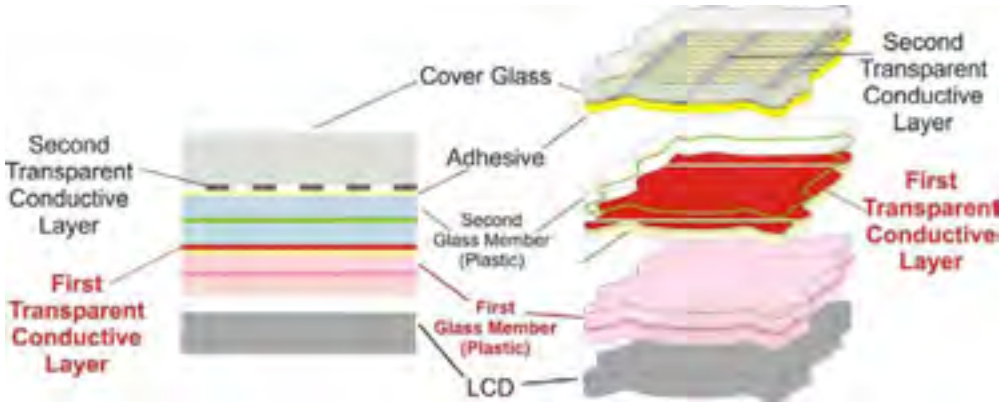


Figure. *Schematic representation of a* ***Samsung Galaxy Tab 10.1*** *touchpanel in cross-section (left) and isometric assembly view (right) with First Glass Member (pink) and First Transparent Conductive Layer (red).*

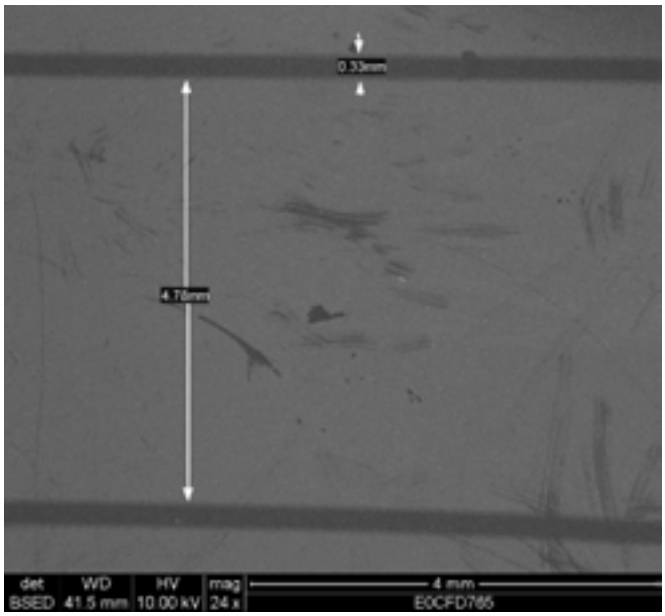


Figure. *Scanning Electron Micrograph (SEM) of the First Transparent Conductive Layer in a* ***Samsung Galaxy Tab 10.1*** *showing the parallel, spaced apart lines having the same pitch and linewidths. See Exhibit C-50.*

89. The Samsung Galaxy Tab 7.0 includes a touch panel with a first transparent conductive layer (labeled First Transparent Conductive Layer, in red, below) disposed over a first glass member (labeled First Glass Member, in pink, below). More specifically, the first transparent conductive layer is the layer of conductive traces on Second Transparent Conductive Layer, which is disposed over the plastic just above the LCD.

90. The first transparent conductive layer comprises a plurality of spaced apart lines having the same pitch and linewidths. In particular, the first transparent conductive layer is comprised of a plurality of parallel lines having a line width of approximately 4.2 mm and separated by a 0.24 mm gap with a pitch (defined as the center to center spacing of the parallel lines on the first transparent conductive layer) of approximately 8.6 – 8.7 mm**.**

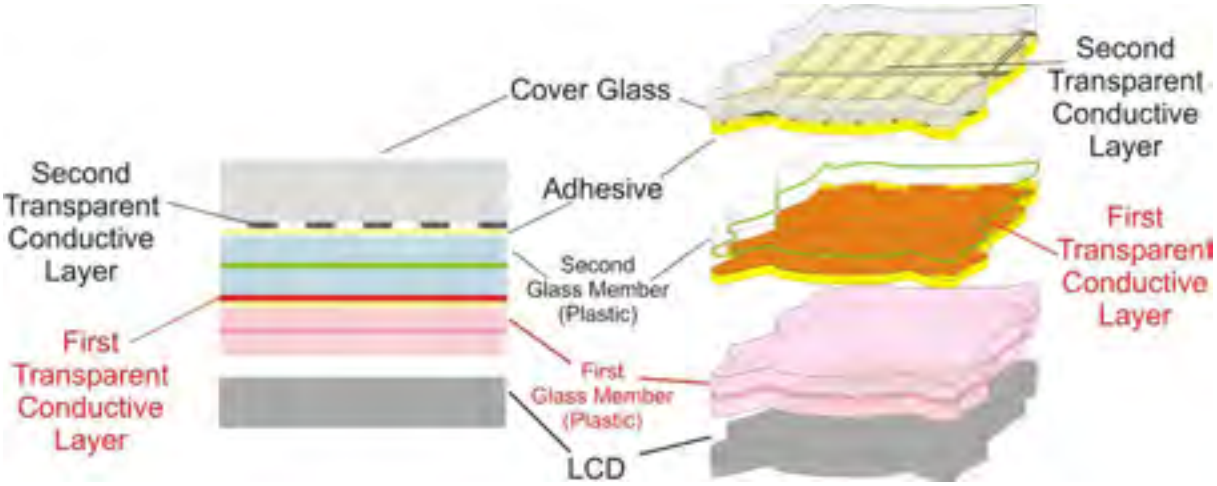


Figure. *Schematic representation of a* ***Samsung Galaxy Tab 7.0*** *touchpanel in cross-section (left) and isometric assembly view (right) with First Glass Member (pink) and First Transparent Conductive Layer (red).*

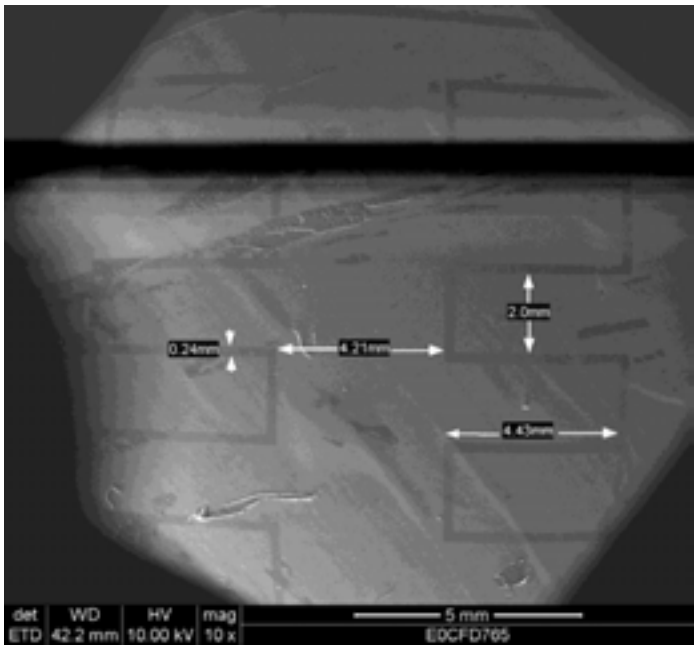


Figure. *Scanning Electron Micrograph (SEM) of the First Transparent Conductive Layer in a Galaxy Tab 7.0 showing the parallel, spaced apart lines having the same pitch and linewidths. See Exhibit D-12*

91. Note that for purposes of this analysis, here and elsewhere with respect to this patent, I have applied the meaning of "over" to mean above but not necessarily attached. In this sense, I am using the common meaning of "over" as when used in the phrase "I have placed my hand over the table." There is no logical requirement in normal usage that this phrase necessarily means that "I have placed my hand directly on the table with no intervening space or objects." That reading is unnecessary and not logical. In any event, I conclude that the "first transparent conductive layer" is over AND directly attached to the "first glass member" in each instance of the accused Samsung products. To the extent, Samsung argues that only one layer with the "glass member" is the "glass member," I think they are wrong, as I outlined above, and I think it results in at best a substantial equivalent configuration, as outlined above. Moreover, if Samsung argues that "over" means "over AND directly attached to," I conclude that including an intervening clear plastic layer (which is attached to another clear plastic layer to constitute the "member") is substantially equivalent to, interchangeable with, and would perform substantially the same function (not blocking or adversely affecting light and serving as a base for attachment of clear

conductive material), in substantially the same way (permitting passage of the light and affixation of the clear conductive material), to achieve substantially the same result (have minimal effect on the user's visual experience of the display and minimizing the overall thickness of the display) as a single-layer "glass member" attached directly to the conductive layer. As noted above, a multi-layer member may be chosen for ease of manufacture or shipment prior to manufacture. Such differences are irrelevant to the purpose of the claimed feature.

17. "a second glass member disposed over the first transparent conductive layer;"

92. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because in each "a second glass member disposed over the first transparent conductive layer." For purposes of this analysis, I have applied the meaning of "glass member" as defined in the '607 Patent, in which the plastic or actual glass are used interchangeably, much like a "glass of water" is a "glass of water" even if the container is made of plastic or some other material. For example, the patent expressly states at column 16, lines 46-49, "any suitable glass or plastic material may be used for the glass members." This is just a self-evident short-hand phrasing that the inventors used and is not uncommon in every-day life. In each of the Apple products I examined, there is a first member of glass disposed over the screen of the display. In the event that "glass member" must literally be composed of just actual glass, I find that the use of other materials such as plastic is substantially equivalent to, interchangeable with, and would perform substantially the same function (not blocking or adversely affecting light), in substantially the same way (permitting passage of the light), to achieve substantially the

same result (have minimal effect on the user's visual experience of the display) as chemically pure glass. Indeed, the '607 Patent at column 16, lines 46-49, expresses exactly that concept.

93. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 contains a second glass member (labeled Second Glass Member, in pink, below) disposed over the first transparent conductive layer (labeled First Transparent Conductive Layer, in red, below). Specifically, a layer of plastic, illustrated in the schematic below (labeled Second Glass Member below, in red), is disposed over the first transparent conductive layer.

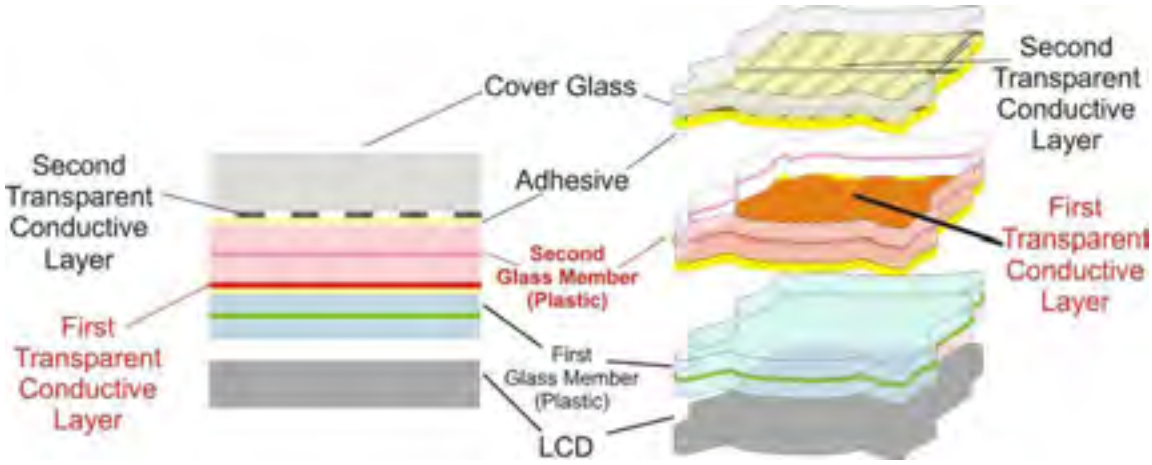


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in cross-section (left) and isometric assembly view (right) with Second Plastic Layer (pink) and First Transparent Conductive Layer (red).*

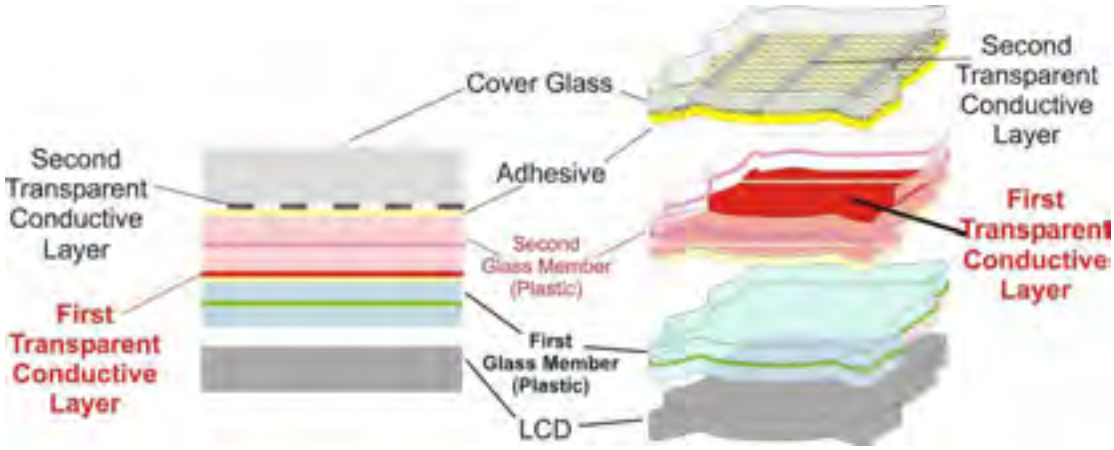


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touchpanel in cross-section (left) and isometric assembly view (right) with Second Glass Member (pink) and First Transparent Conductive Layer highlighted (red).*

94. For purposes of this analysis, I have applied the meaning of "glass member" as defined in the '607 Patent, in which the plastic or actual glass are used interchangeably, much like a "glass of water" is a "glass of water" even if the container is made of plastic or some other material. For example, the patent expressly states at column 16, lines 46-49, "any suitable glass or plastic material may be used for the glass members." This is just a self-evident short-hand phrasing that the inventors used and is not uncommon in every-day life. In each of the Apple products I examined, there is a first member of glass disposed over the screen of the display. In the event that "glass member" must literally be composed of just actual glass, I find that the use of other materials such as plastic is substantially equivalent to, interchangeable with, and would perform substantially the same function (not blocking or adversely affecting light), in substantially the same way (permitting passage of the light), to achieve substantially the same result (have minimal effect on the user's visual experience of the display) as chemically pure glass. Indeed, the '607 Patent at column 16, lines 46-49, expresses exactly that concept.

95. Note also that for purposes of this analysis, I have applied the meaning of "member" to be a unit that is not necessarily comprised of a single layer or a single substance. Much like a piece of plywood is a "wood member," even though it is a composite unit of many materials and layers, the patent makes no distinction or restriction with respect to the content of a "member." Here I conclude that the "member" at issue may be comprised of two layers of plastic glued (or "taped" together).). Samsung treats this unit of layers as a single "member" – it has its own single unique part number and it is purchased as a single sheet from a supplier and then added to the device as a single member. (SAMNDCA00324077; SAMNDCA00298802 at 819, 840, and 926; SAMNDCA00299040 at 062, 065, 066.) Thus, I conclude that the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meet this limitation because in each of the Samsung products I examined, there is a "second glass member."

96. In the event that "glass member" must be only a single layer of a single material, I conclude that such a composite member is substantially equivalent to, interchangeable with, and would perform substantially the same function (not blocking or adversely affecting light and serving as a base for attachment of clear conductive material), in substantially the same way (permitting passage of the light and affixation of the clear conductive material), to achieve substantially the same result (have minimal effect on the user's visual experience of the display and minimizing the overall thickness of the display) as a single-layer "glass member." A multi-layer member may be chosen for ease of manufacture or shipment prior to manufacture. Such differences are irrelevant to the purpose of the claimed feature.

97. Note also that for purposes of this analysis, here and elsewhere with respect to this patent, I have applied the meaning of "over" to mean above but not necessarily attached. In this sense, I am using the common meaning of "over" as when used in the phrase "I have placed my hand over the table." There is no logical requirement in normal usage that this phrase necessarily means that "I have placed my hand directly on the table with no intervening space or objects." That reading is unnecessary and not logical. In any event, I conclude that the "second glass member" is over AND directly attached to the "first transparent conductive layer" in each instance of the accused Samsung products. To the extent that Samsung argues that only one layer with the "glass member" is the "glass member," I think they are wrong, as I outlined above, and I think it results in at best a substantial equivalent configuration, as outlined above. Moreover, if Samsung argues that "over" means "over and directly attached to," I conclude that including an intervening clear plastic layer (which is attached to another clear plastic layer to constitute the "member") is substantially equivalent to, interchangeable with, and would perform substantially the same function (not blocking or adversely affecting light and serving as a base for attachment of clear conductive material), in substantially the same way (permitting passage of the light and affixation of the clear conductive material), to achieve substantially the same result (have minimal effect on the user's visual experience of the display and minimizing the overall thickness of the display) as a single-layer "glass member" attached directly to the conductive layer. As noted above, at most, a multi-layer member may be chosen for ease of manufacture or

shipment prior to manufacture. Such differences are irrelevant to the purpose of the claimed feature.

18. "a second transparent conductive layer disposed over the second glass member, the second transparent conductive layer comprising a plurality of spaced apart parallel lines having the same pitch and linewidths, the parallel lines of the second transparent conductive layer being substantially perpendicular to the parallel lines of the first transparent conductive layer;"

98. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because they have "a second transparent conductive layer disposed over the second glass member, the second transparent conductive layer comprising a plurality of spaced apart parallel lines having the same pitch and linewidths, the parallel lines of the second transparent conductive layer being substantially perpendicular to the parallel lines of the first transparent conductive layer." In particular, as noted above, the Apple products include a layer of transparent ITO as a second conductive layer. That layer is disposed over the "second glass member," in each of the devices and is made up of spaced apart parallel lines with common pitch and linewidths that run perpendicular to the first transparent conductive ITO layer.

99. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 7.0 contains a second transparent conductive layer (labeled Second Transparent Conductive Layer, in red, below) disposed over the second glass member (labeled Second Glass Member, in pink, below). The second transparent conductive layer comprises a plurality of parallel lines, spaced apart, having the same pitch and linewidths, with the parallel lines of the second transparent conductive layer being substantially

perpendicular to the parallel lines of the first transparent conductive layer. The conductive lines on the first and second layers of the touch panel within the Galaxy Tab 7.0 are thus oriented substantially along the X and Y axes of a Cartesian grid, respectively, and are therefore substantially perpendicular to one another.

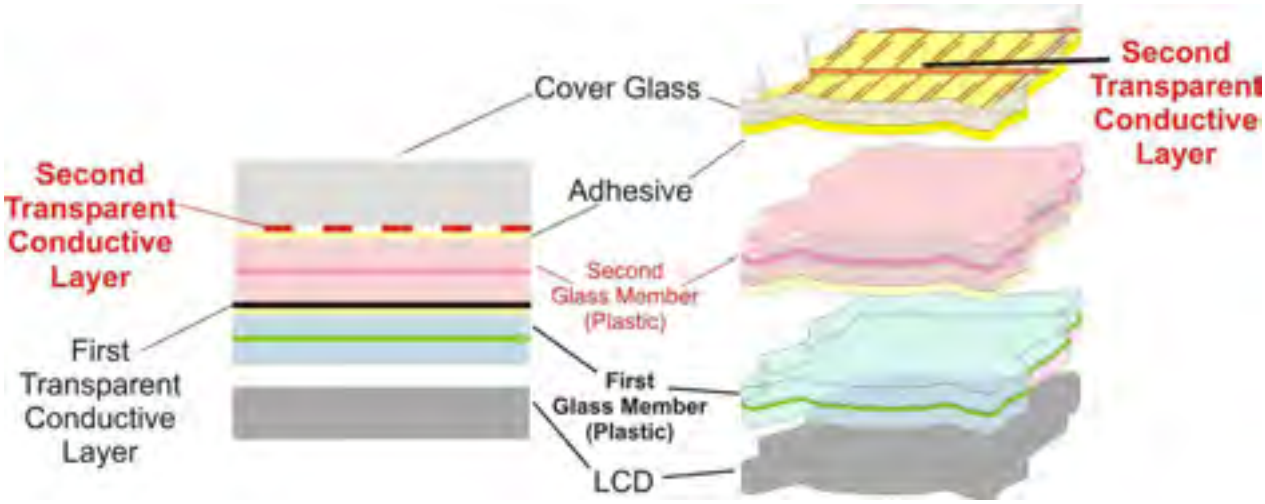


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in cross-section (left) and isometric assembly view (right) with Second Glass Member (pink) and Second Transparent Conductive Layer (red).*

100. More specifically, as shown below, the second transparent conductive layer comprises a plurality of parallel spaced-apart lines having the same linewidth, which is approximately 0.93 mm with a 8.0 mm gap resulting in a pitch (defined as the center to center spacing of parallel lines on the second transparent conductive layer) of approximately 8.9 - 9.00 mm.

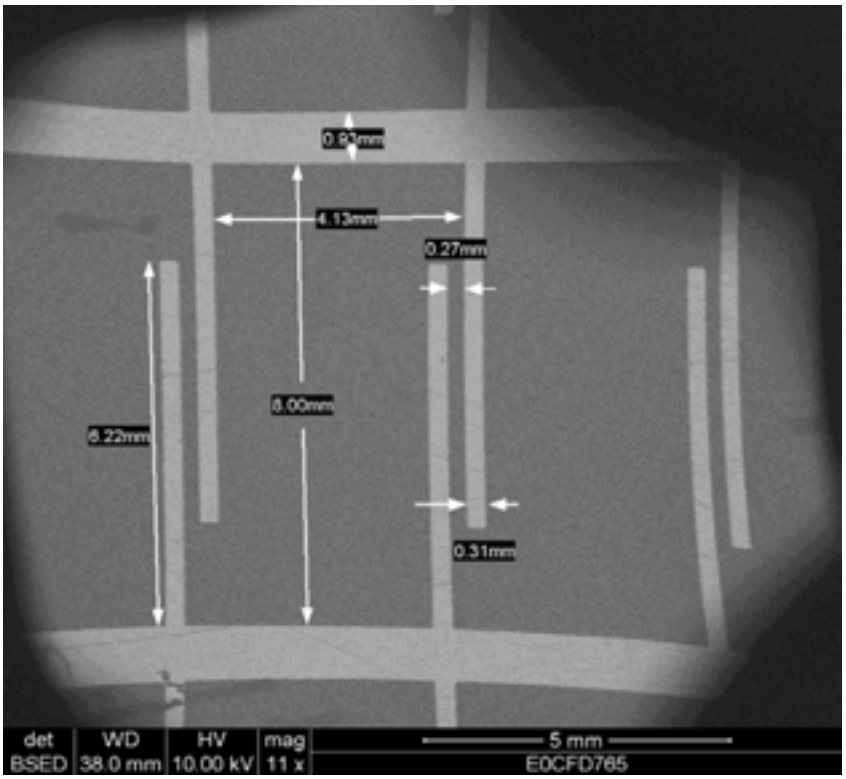


Figure. *Scanning Electron Micrograph (SEM) of the Second Transparent Conductive Layer in a Galaxy Tab 7.0. See Exhibit D-17.*

101. The Samsung Galaxy Tab 10.1 contains a second transparent conductive layer (labeled Second Transparent Conductive Layer, in red, below) disposed over the second glass member (labeled Second Glass Member, in pink, below). The second transparent conductive layer comprises a plurality of parallel lines, spaced apart, having the same pitch and linewidths, with the parallel lines of the second transparent conductive layer being substantially perpendicular to the parallel lines of the first transparent conductive layer. The conductive lines on the first and second layers of the touch panel within the Galaxy Tab 10.1 are thus oriented substantially along the X and Y axes of a Cartesian grid, respectively, and are therefore substantially perpendicular to one another.

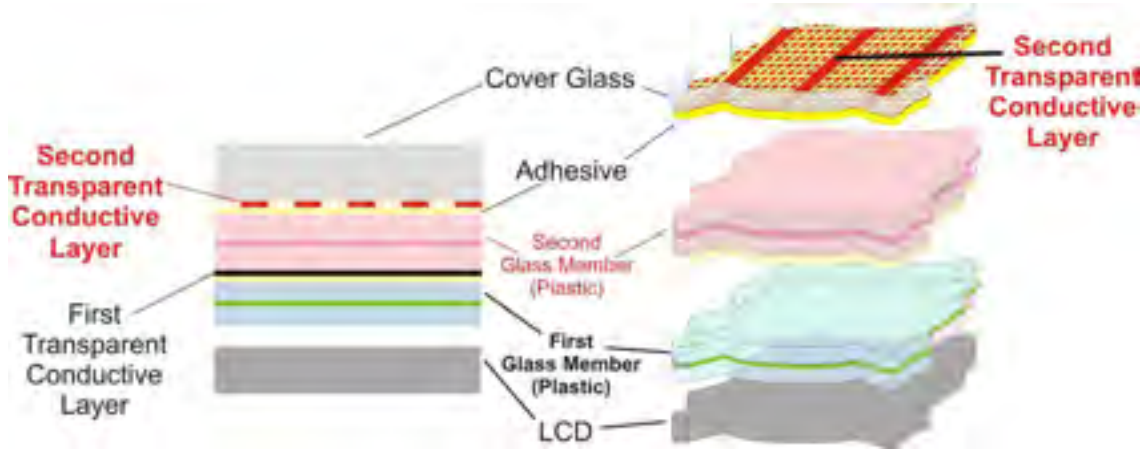


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touchpanel in cross-section (left) and isometric assembly view (right) with Second Plastic Layer and Second Transparent Conductive Layer highlighted in red.*

102. More specifically, as shown below, the second transparent conductive layer comprises a plurality of parallel spaced-apart lines having the same linewidth, which is approximately 0.33 mm with a 4.78 mm gap resulting in a pitch (defined as the center to center spacing of parallel lines on the second transparent conductive layer) of approximately 5 mm.

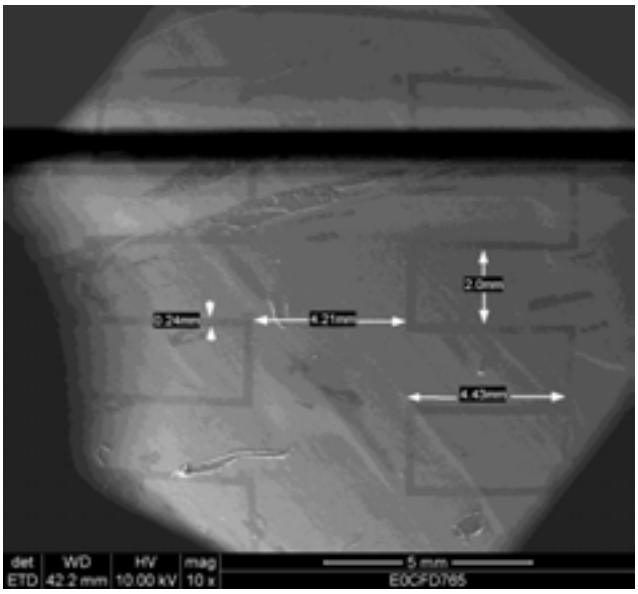


Figure. *Scanning Electron Micrograph (SEM) of the First Transparent Conductive Layer in a Galaxy Tab 10.1. See Exhibit C-48 and Exhibit C-50.*

103. For purposes of this analysis, I have applied the meaning of "glass member" as defined in the '607 Patent, in which the plastic or actual glass are used interchangeably, much like a "glass of water" is a "glass of water" even if the container is made of plastic or some other material. For example, the patent expressly states at column 16, lines 46-49, "any suitable glass or plastic material may be used for the glass members." This is just a self-evident short-hand phrasing that the inventors used and is not uncommon in every-day life. In each of the Apple products I examined, there is a first member of glass disposed over the screen of the display. In the event that "glass member" must literally be composed of just actual glass, I find that the use of other materials such as plastic is substantially equivalent to, interchangeable with, and would perform substantially the same function (not blocking or adversely affecting light and serving as a base for attachment of clear conductive material), in substantially the same way (permitting passage of the light and affixation of the clear conductive material), to achieve substantially the same result (have minimal effect on the user's visual experience of the display and minimizing the overall thickness of the display) as chemically pure glass. Indeed, the '607 Patent at column 16, lines 46-49, expresses exactly that concept.

104. Note also that for purposes of this analysis, I have applied the meaning of "member" to be a unit that is not necessarily comprised of a single layer or a single substance. Much like a piece of plywood is a "wood member," even though it is a composite unit of many materials and layers, the patent makes no distinction or restriction with respect to the content of a "member." Here I conclude that the "member" at issue may be comprised of two layers of plastic glued (or "taped" together). Samsung treats this unit of layers as a single "member" – it has its own single unique part number and it is purchased as a single sheet from a supplier and then added to the device as a single member. (SAMNDCA00324077; SAMNDCA00298802 at 819, 840, and 926; SAMNDCA00299040 at 062, 065, 066.) Thus, I conclude that the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meet this limitation because in each of the Samsung products I examined, there is a "second glass member."

105. In the event that "glass member" must be only a single layer of a single material, I conclude that such a composite member is substantially equivalent to, interchangeable with, and

would perform substantially the same function (not blocking or adversely affecting light and serving as a base for attachment of clear conductive material), in substantially the same way (permitting passage of the light and affixation of the clear conductive material), to achieve substantially the same result (have minimal effect on the user's visual experience of the display and minimizing the overall thickness of the display) as a single-layer "glass member." At most, a multi-layer member may be chosen for ease of manufacture or shipment prior to manufacture. Such differences are irrelevant to the purpose of the claimed feature.

106. Note that for purposes of this analysis, here and elsewhere with respect to this patent, I have applied the meaning of "over" to mean above but not necessarily attached. In this sense, I am using the common meaning of "over" as when used in the phrase "I have placed my hand over the table." There is no logical requirement in normal usage that this phrase necessarily means that "I have placed my hand directly on the table with no intervening space or objects." That reading is unnecessary and not logical. In any event, I conclude that the "second transparent conductive layer" is over AND directly attached to the "second glass member" in each instance of the accused Samsung products. To the extent, Samsung argues that only one layer with the "glass member" is the "glass member," I think they are wrong, as I outlined above, and I think it results in at best a substantial equivalent configuration, as outlined above. Moreover, if Samsung argues that "over" means "over and directly attached to," I conclude that including an intervening clear plastic layer (which is attached to another clear plastic layer to constitute the "member") is substantially equivalent to, interchangeable with, and would perform substantially the same function (not blocking or adversely affecting light and serving as a base for attachment of clear conductive material), in substantially the same way (permitting passage of the light and affixation of the clear conductive material), to achieve substantially the same result (have minimal effect on the user's visual experience of the display and minimizing the overall thickness of the display) as a single-layer "glass member" attached directly to the conductive layer. As noted above, a multi-layer member may be chosen for ease of manufacture or shipment prior to manufacture. Such differences are irrelevant to the purpose of the claimed feature.

19. "a third glass member disposed over the second transparent conductive layer;"

107. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted]. I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because they include "a third glass member disposed over the second transparent conductive layer." In particular, all of the Apple products I examined included a third "glass member" over the second transparent ITO conductive layer. This "glass member" is the cover glass of the display itself.

108. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 10.1 contains a third glass member (labeled Cover Glass, in pink, below) disposed over the second transparent conductive layer (labeled Second Transparent Conductive Layer, in red, below).

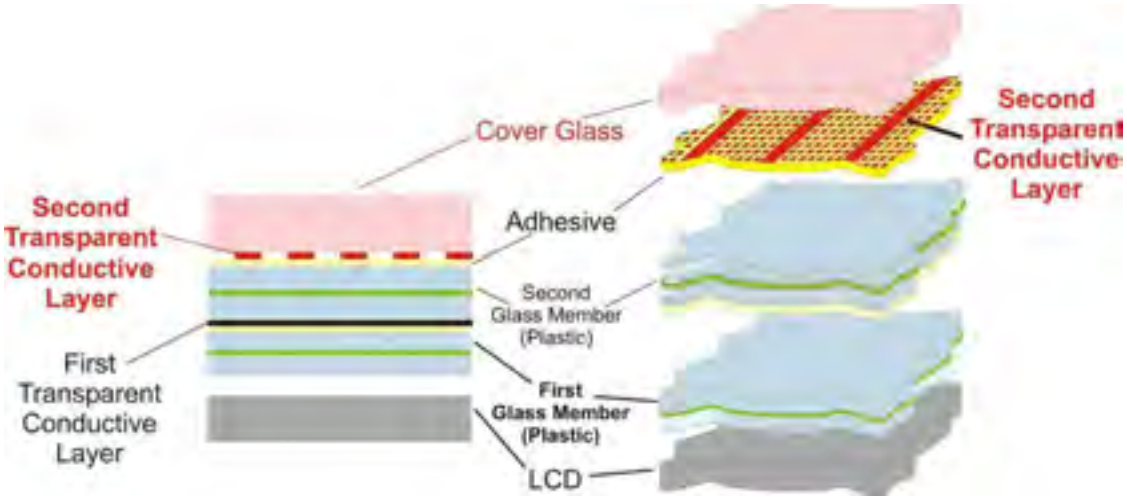


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touchpanel in cross-section (left) and isometric assembly view (right) with Cover Glass (pink) and Second Transparent Conductive Layer (red).*

109. The Samsung Galaxy Tab 7.0 contains a third glass member (labeled Cover Glass, in pink, below) disposed over the second transparent conductive layer (labeled Second Transparent Conductive Layer, in red, below). More specifically, the Samsung Galaxy Tab 7.0 contains a glass member in the form of tempered glass. From the Galaxy Tab User 7.0 Manual: "Using excessive force or a metallic object when pressing on the touch-screen may damage the tempered glass surface and void the warranty." APLNDC-Y0000057718; APLNDC-Y0000063883.

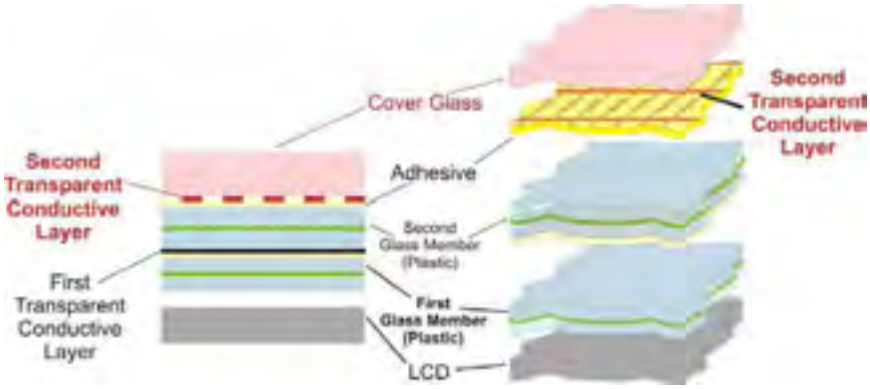


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in cross-section (left) and isometric assembly view (right) with Cover Glass (pink) and Second Transparent Conductive Layer (red).*

110. For purposes of this analysis, I have applied the meaning of "glass member" as defined in the '607 Patent, in which the plastic or actual glass are used interchangeably, much like a "glass of water" is a "glass of water" even if the container is made of plastic or some other material. For example, the patent expressly states at column 16, lines 46-49, "any suitable glass or plastic material may be used for the glass members." This is just a self-evident short-hand phrasing that the inventors used and is not uncommon in every-day life. In each of the Apple and Samsung products I examined, there is a first member of glass disposed over the screen of the display. In any event, in this particular instance the cover glass at issue is, in fact, glass.

111. Note also that for purposes of this analysis, I have applied the meaning of "member" to be a unit that is not necessarily comprised of a single layer or a single substance. Much like a piece of plywood is a "wood member," even though it is a composite unit of many materials and layers, the patent makes no distinction or restriction with respect to the content of a "member." Here I conclude that the "member" at issue may be comprised of two layers of plastic glued (or "taped" together). Samsung treats this unit of layers as a single "member" – it has its own single unique part number and it is purchased as a single sheet from a supplier and then added to the device as a single member. (SAMNDCA00324077; SAMNDCA00298802 at 819, 840, and 926; SAMNDCA00299040 at 062, 065, 066.) Thus, I conclude that the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meet this limitation because in each of the Samsung products I examined, there is a "third glass member." In any event, in this particular instance the cover glass at issue is, in fact, a single unit of glass.

112. Note also that for purposes of this analysis, here and elsewhere with respect to this patent, I have applied the meaning of "over" to mean above but not necessarily attached. In this sense, I am using the common meaning of "over" as when used in the phrase "I have placed my hand over the table." There is no logical requirement in normal usage that this phrase necessarily means that "I have placed my hand directly on the table with no intervening space or objects." That reading is unnecessary and not logical. In any event, In any event, in this particular instance the cover glass at issue is, in fact, glass covering directly the second transparent conductive layer.

20. "and one or more sensor integrated circuits operatively coupled to the lines."

113. I have spoken to the named-inventors of the '607 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted]

[redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because they include "one or more sensor integrated circuits operatively coupled to the lines." Indeed, all of the Apple products I examined include touch-sensor integrated circuits for sensing the operative capacitive coupling between the sense and drive lines in a mutual capacitance method.

114. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. As shown above, the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 include one or more sensor integrated circuits operatively coupled to the conductive lines. As shown above, the intersections of the first and second conductive lines act as capacitive sensors. As shown above, the touchscreen in the Samsung Galaxy Tab 10.1 is a mutual capacitance touchscreen, which includes two sets of spatially separated traces, oriented perpendicular to each other. As set forth above, one set of conductive lines are connected to the capacitive monitoring circuitry. When a current is driven through elements on the other set of lines, the capacitive monitoring circuitry can detect changes in charge coupling between the first and second set of conductive lines when an object is on or near the touchscreen.

115. The Galaxy Tab 7.0 employs the Atmel mxt224 touchscreen controller to monitor capacitance changes. According to the Atmel website, the Atmel mxt224 is part of the maXTouch family of controllers (http://www.atmel.com/devices/mxt224.aspx ,accessed 14 March 2012) (APLNDC-Y0000234088–89 at APLNDC-Y0000234088). Additionally, the mxt224 is "A 224-node highly configurable touchscreen controller that is part of the Atmel maXTouch product platform. An optimal and scalable architecture enables smart processing of a capacitive touch image to accurately regenerate and report the user's interaction with the touchscreen. Multi-touch performance identifies and individually tracks touches and allows a range of built-in gestures . . . ." *(Id.)*

116. The Galaxy Tab 10.1 employs the Atmel mxt1386 and mxt154 touchscreen controller set to monitor capacitance changes. According to the Atmel website, the Atmel mxt1386/mxt154 set is part of the maXTouch family of controllers. (APLNDC-Y0000234084-086 at 085.) Additionally, the mxt1386 is "A 1386-node multi-chip solution (4-chips) which is

part of the Atmel maXTouch™ product platform. By combining charge transfer and powerful 32-bit AVR microcontroller technology, this high performance architecture enables unlimited touch up to 16 touches, fast response time at over 150Hz, and smart processing of a capacitive touch image to accurately regenerate and report user interaction with the touchscreen. By supporting grip suppression and palm rejection, the screen enables unconstrained usage and intuitive user experience. The device features multi-touch performance, enabling touches to be identified and individually tracked and allowing a range of built-in gestures . . . ." *(Id.)*

117. In the Galaxy Tab 7.0 and Galaxy Tab 10.1, the conductive lines are necessarily connected to sensor integrated circuits, as information relating to touches occurring on the touchscreen is conveyed from the touchscreen, via its controller, and/or driver software, to the Android software platform. The Samsung Galaxy Tab 10.1 includes one or more sensor integrated circuits operatively coupled to the conductive lines (see images below). As shown above, the intersections of the first and second conductive lines act as capacitive sensors. Moreover, the touchscreen of the Galaxy Tab 10.1 is responsive to touches occurring on the touchscreen, such as gestures used to navigate the device. (Tab 10.1 User Manual at APLNDC-Y0000060382; APLNDC-Y0000065305-427 at 325.) Again, the conductive lines of the Galaxy Tab's touchscreen must necessarily be connected to sensor circuitry to enable the detection of these touches and the device's response to them.

Figure. *Camera image of the Galaxy Tab 10.1 touch screen, connective flexboard, and circuit board. See Exhibit C-64.*

118. The Samsung Galaxy Tab 7.0 includes one or more sensor integrated circuits operatively coupled to the conductive lines (see images below). As shown above, the intersections of the first and second conductive lines act as capacitive sensors. The conductive lines are necessarily connected to sensor integrated circuits, as information relating to touches occurring on the touchscreen is conveyed from the touchscreen, via its controller, and/or driver software, to the Android software platform. Moreover, the touchscreen of the Galaxy Tab 7.0 is responsive to touches occurring on the touchscreen, such as gestures used to navigate the device. (APLNDC-Y0000057563-6; APLNDC-Y0000063885.) Again, the conductive lines of the Galaxy Tab's touchscreen must necessarily be connected to sensor circuitry to enable the detection of these touches and the device's response to them.

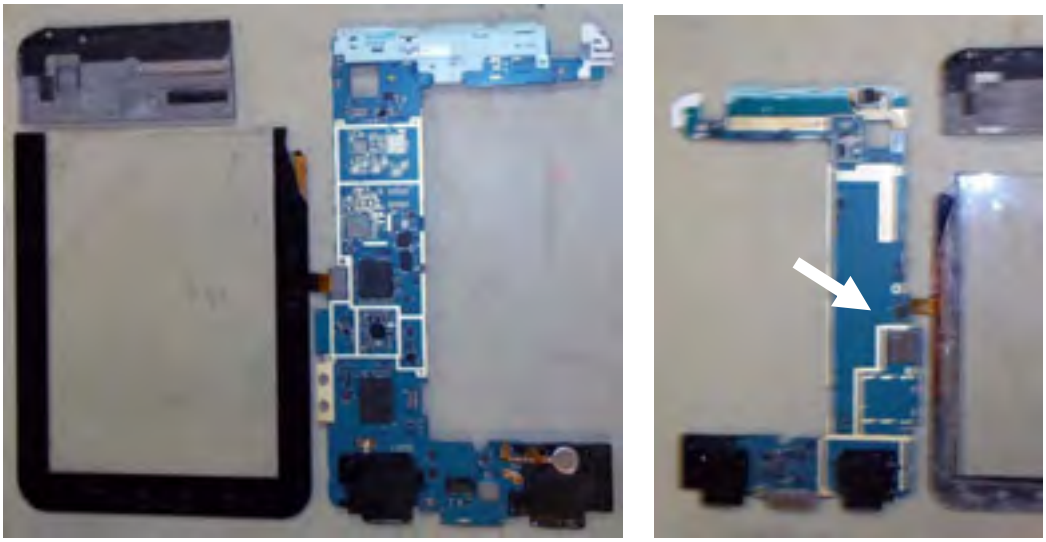


Figure. *Camera image of the Galaxy Tab 7.0 touch screen, connective flexboard, and circuit board. See Exhibit D-49 and Exhibit D-51. The mxt224controller is visible in the right image (white arrow) adjacent to the flex connector.*

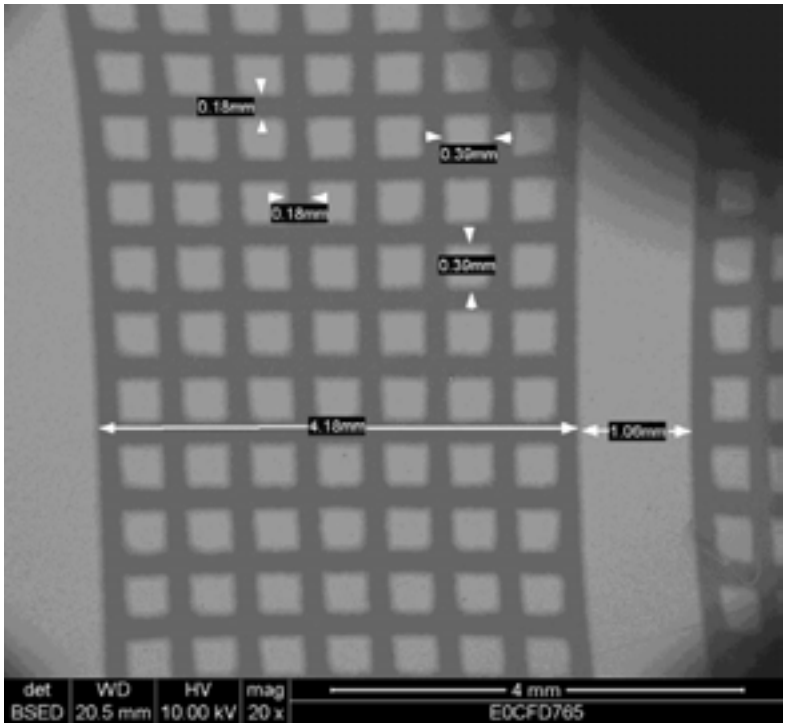
119. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 10 of the ’607 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad and iPad 2 products meet the limitations, they embody the invention of this claim.

21. Claim 11: “The display arrangement as recited in claim 10 further including dummy features disposed in the space between the parallel lines, the dummy features optically improving the visual appearance of the touch screen by more closely matching the optical index of the lines.”

120. I have spoken to the named-inventors of the ’607 Patent claims who were working on designs for Apple’s products when they conceived of their invention and I have examined the Apple iPhones and the iPad and iPad 2 products and reviewed documents relating to their operation including, for example, [redacted]

[redacted] I conclude that the Apple iPhones and the iPad and iPad 2 products meet this limitation because they each include "dummy features disposed in the space between the parallel lines, the dummy features optically improving the visual appearance of the touch screen by more closely matching the optical index of the lines." I have visually inspected these features in the Apple products.

121. The Samsung Galaxy Tab 10.1 devices also meet these limitations. These devices includes dummy features disposed in the space between the parallel lines, the dummy features optically improving the visual appearance of the touchscreen by more closely matching the optical index of the lines. The dummy features are composed of the same, or substantially the same, material as the conductive lines, such as ITO, and therefore closely match the optical index of the lines. The cells are not electrically connected to each other, or to the conductive lines themselves.



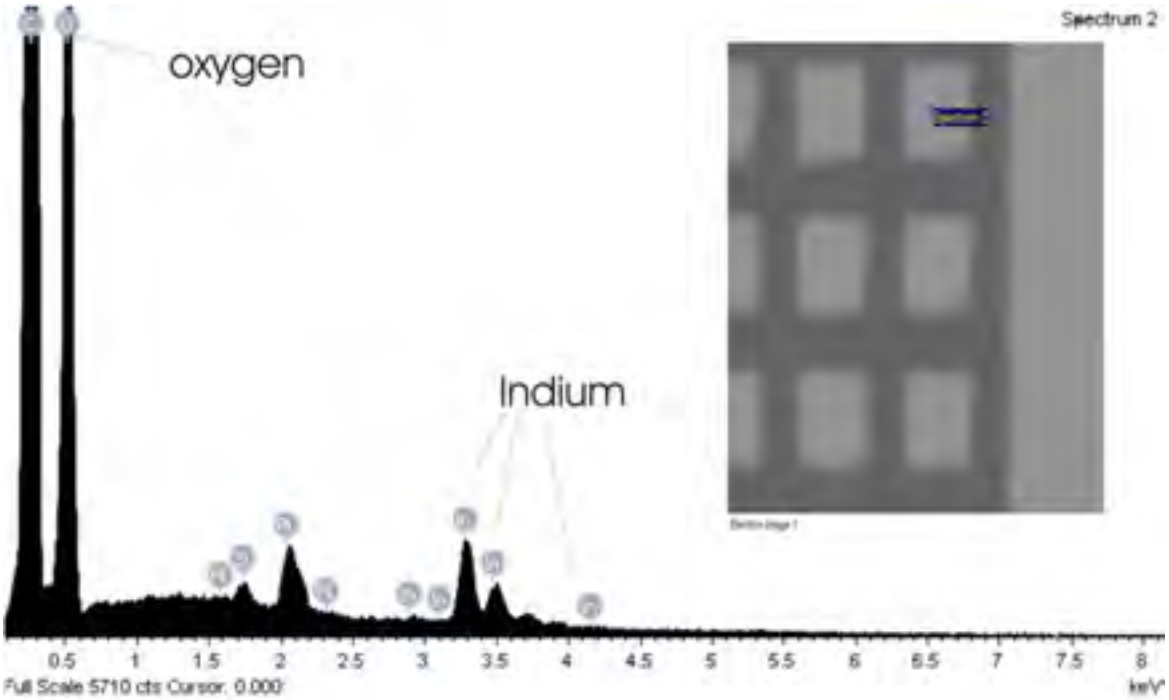


Figure. *(above) Scanning Electron Micrographs (SEM) of the Second Conductive Layer in the* ***Samsung Galaxy Tab 10.1****. The dummy features are the square patterns seen between electrodes, which are not electrically connected to each other or to other electrodes. (below) Labeled XPS spectra indicating the presence of indium, tin and oxygen in the dummy features, indicating the material is ITO. See Exhibit C-17 and Exhibit C-23.*

122. Because each of the Samsung Galaxy Tab 10.1 devices meets each and every limitation of claim 11 of the ’607 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad and iPad 2 products meet the limitations, they embody the invention of this claim.

VI. UNITED STATES PATENT NO. 7,920,129 (SHIELD/DRIVE LAYER)

123. For the reasons set out below, it is my opinion that at least the sale, offer for sale, use, and/or importation in the United States of the Samsung Galaxy Tab 7.0 and Samsung Galaxy Tab 10.1 devices infringes claims 1, 3, 5, 7, 9-10, 12, 14, 16, 24, 26, and 28 of the '129 Patent ("the asserted claims of the '129 Patent").

124. The '129 Patent, entitled "Double-sided Touch-sensitive Panel with Shield and Drive Combined Layer," was invented by Steve Hotelling and Brian Land and is assigned to Apple, Inc. The '129 Patent issued on April 5, 2011. The patent application leading to the '129 Patent was filed on January 3, 2007.

A. Person of Ordinary Skill in the Art

125. If called to testify at trial on the topic of the definition of a person of ordinary skill in the art for the '129 Patent, I expect to testify regarding the skill, education, and experience that a person of ordinary skill in the relevant art would have had at the time of the invention of the '129 Patent. In my opinion, the relevant art involves touchscreens. In my opinion, a person of ordinary skill in the relevant art of the '129 Patent at the time of the invention would have a Bachelor's degree in electrical engineering, physics, computer engineering, or an equivalent, and two or more years of experience working with input devices.

B. Priority Date

126. If called to testify at trial on the topic of the priority date of the '129 Patent, I expect to rely on inventor testimony and corroborating evidence (such as kept notebooks) to render an opinion concerning an earlier date of conception and reduction to practice of the claimed invention of the '129 Patent. [redacted]

[redacted]

127. [redacted]

The asserted claims were constructively reduced to practice on January 3, 2007. Documents relating to these facts are found in, for example: [redacted]

C. Background of the Inventions

128. The'129 Patent discloses an elegant touch-screen solution for electronic devices, particularly graphics-based mobile or hand-held devices that have high-resolution displays and require human interaction.

129. As more fully developed below, the claimed inventions of the ’129 Patent relate to a specific configuration of conductive lines that helps prevent electrical interference from the display elements from interfering with the touch sensor conductive lines that are designed to detect the electrical coupling of a finger on the touch screen overlaying the display. The’129 Patent claims recite an innovative combination of elements including the use a wide set of second conductive layers to effectively shield the thinner sense conductive lines from the electrical noise of the display (such as an LCD display). This arrangement permits the designer to eliminate additional layers in the touch sensor, thus reducing costs and overall thickness required to have a viable hand-held computing device.

D. Detailed Analysis of ’129 Patent Claims: Infringement/Embodiment

130. I have compared the elements recited in claims 1-3, 5, 7, 9-12, 14, 16, 26 and 28 of the ’129 Patent (again, “the asserted claims of the ’129 Patent”) to Apple’s iPhone, iPod Touch, and iPad products and Samsung’s Galaxy Tab 7.0 and Galaxy Tab 10.1. The analysis below provides my opinions concerning whether the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 products infringe the claims and whether the Apple products embody the claims. My infringement views are supplemented by Exhibits F and G hereto (the claim chart presented as Exhibits 18 and 19 to Apple’s Infringement Contentions). The infringement evidence illustrated below is exemplary and not exhaustive, and may be supplemented based upon new evidence produced by Samsung or others, including any experts who may present reports or testify in this action.

131. In my opinion, Samsung’s Galaxy Tab 7.0 and Galaxy Tab 10.1 literally infringe the asserted claims of the ’129 Patent and the iPad and iPhone products embody the asserted claims of the ’129 Patent.

2. Claim 1 Preamble: “A capacitive touch sensor panel, comprising.”

132. I have spoken to the named-inventors of the ’129 Patent claims who were working on designs for Apple’s products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted]

[redacted] I conclude that those Apple products meet this limitation because they include "A capacitive touch sensor panel." Indeed, all of the Apple products I examined included a touch sensor that is based upon measurement or detection of capacitive coupling.

133. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 10.1 has a capacitive touch sensor panel. Specifically, the Galaxy Tab 10.1 contains a 10.1-inch WXGA TFT (PLS) LCD touchscreen. (*See, e.g.,* Tab 10.1 User Manual at APLNDC-Y0000060376). The Samsung Galaxy Tab 7.0 has a capacitive touch sensor panel. The Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. This is described and shown in the Samsung Galaxy Tab User 7.0 Manual. APLNDC-Y0000063879.

3. Claim 1: "a first set of traces of conductive material arranged along a first dimension of a two-dimensional coordinate system, the first set of traces having one or more widths including a maximum width"

134. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because they include "a first set of traces of conductive material arranged along a first dimension of a two-dimensional coordinate system, the first set of traces having one or more widths including a maximum width." All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in the first set of traces

(the sense lines) have a maximum width that is less than the minimum width of the second set of traces (the drive lines).

Figure. *From left to right: iPhone, iPhone 3G, iPhone 3GS, iPhone 4, and iPod Touch (above). From left to right: iPad and iPad 2 (below). Photos are not to scale.*

135. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of the Samsung Galaxy Tab 10.1 contains a first set of traces of conductive material arranged along a first dimension of a two-dimensional coordinate system, the first set of traces having one or more widths including a maximum width. Specifically, the first set of traces is composed of a conductive material and oriented along one dimension (the Y axis in the figures below) of a Cartesian grid. As illustrated in the figure below, each of the first set of traces has substantially the same width – a maximum width along their entire lengths.

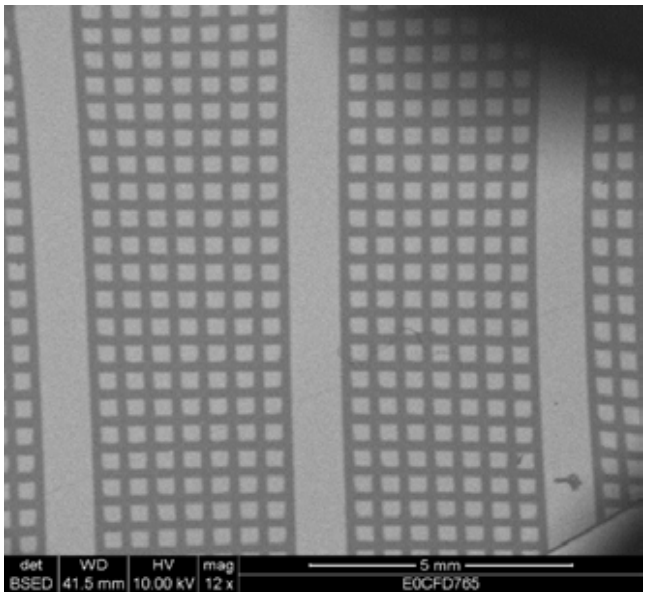


Figure. *Scanning electron micrograph of the first set of traces (running vertical) in a Galaxy Tab 10.1 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. See Exhibit C-15. Moreover, each of the first set of traces has substantially the same width.*

136. The capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 contains a first set of traces of conductive material arranged along a first dimension of a two-dimensional coordinate system, the first set of traces having one or more widths including a maximum width. Specifically, the first set of traces is composed of a conductive material and oriented along one dimension (the Y axis in the figures below) of a Cartesian grid. As illustrated in the figure below, each of the first set of traces has substantially the same width – a maximum width along their entire lengths.

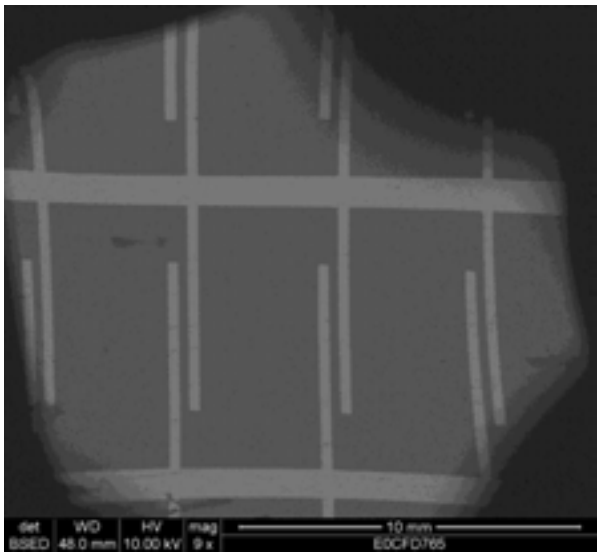


Figure. *Scanning electron micrograph of the first set of traces (running horizontally) in a Galaxy Tab 7.0 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. Moreover, each of the first set of traces has substantially the same width. See Exhibit D-15.*

4. Claim 1: "a second set of traces of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system, the second set of traces having one or more widths including a minimum width;"

137. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because they include "a second set of traces of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system, the second set of traces having one or more widths including a minimum width." All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in the first set of traces (the sense lines) have a maximum width that is less than the minimum width of the second set of traces (the drive lines).

138. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of the Samsung Galaxy Tab 10.1 contains a second set of traces of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system, the second set of traces having one or more widths including a minimum width. More specifically, the second set of traces is composed of a conductive material and oriented along a second

dimension (see Figure, below) of a Cartesian grid. As shown below, each of the second set of traces has substantially the same width – a minimum width along their entire length.

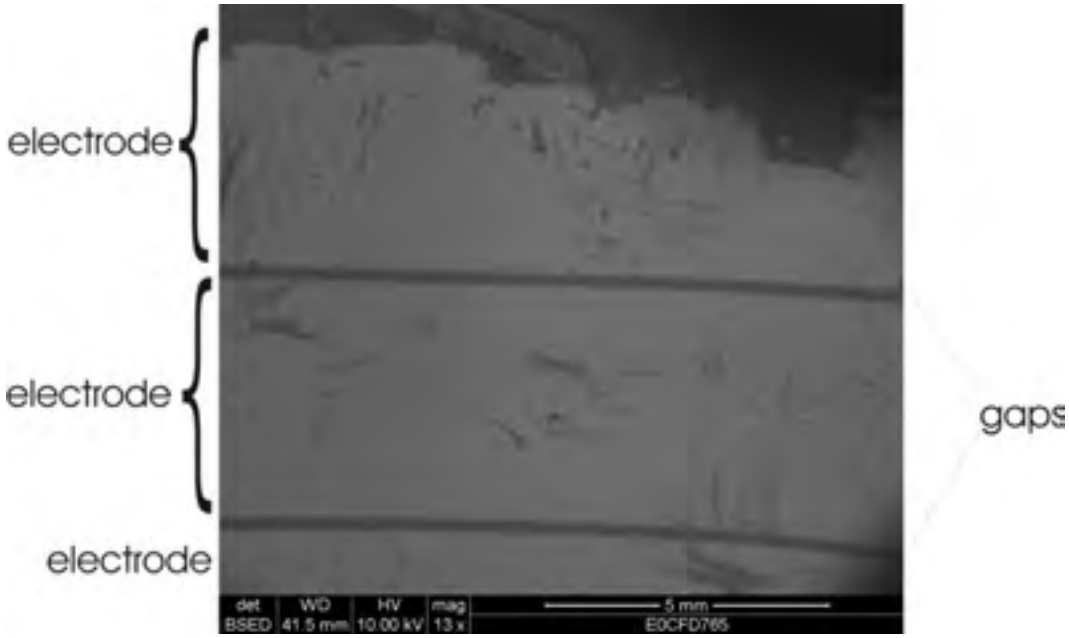


Figure. *Scanning electron micrograph of the second set of traces in a Galaxy Tab 10.1 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. See Exhibit C-48. Moreover, each of the first set of traces has substantially the same width and is separated from its neighbors (0.33 mm).*

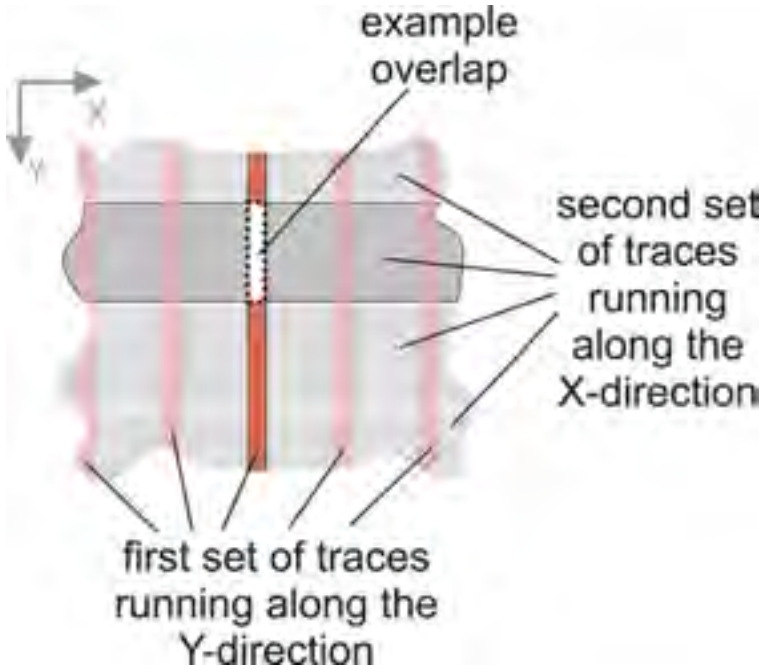


Figure. *Schematic representation of the Samsung Galaxy Tab 10.1 First and Second Set of Trace alignment. Note how the first set runs parallel to the Y-axis of a Cartesian grid and the second set runs parallel to the X-axis of a Cartesian grid. The dummy features between the first set of traces have been omitted for clarity.*

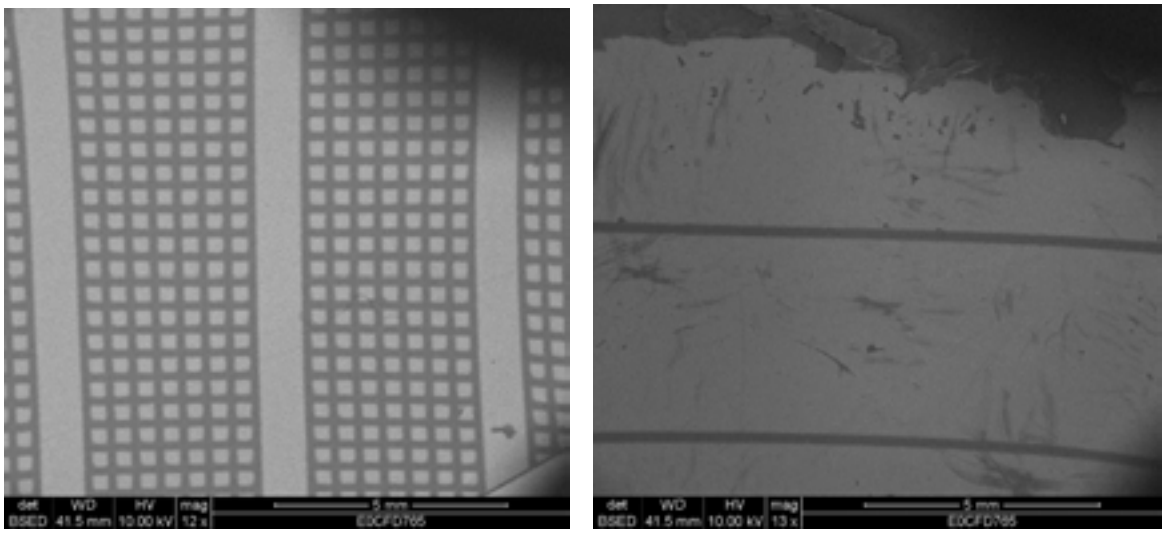


Figure. *Comparison of scanning electron micrographs of the first set of traces (left) and the second set of traces (right) in a Galaxy Tab 10.1. See Exhibit C-15 and Exhibit C-48. The traces are on different layers.*

139. The capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 contains a second set of traces of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system, the second set of traces having one or more widths including a minimum width. More specifically, the second set of traces is composed of a conductive material and oriented along a second dimension (see Figure, below) of a Cartesian grid. As shown below, each of the second set of traces has substantially the same width – a minimum width along their entire length.

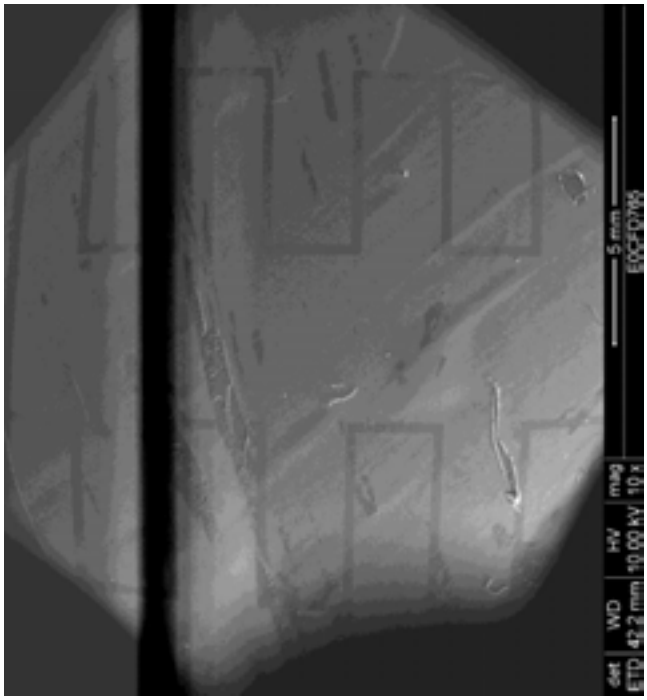


Figure. *Scanning electron micrographs of the second set of traces in a Galaxy Tab 7.0 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. See Exhibit D-11. Moreover, each of the first set of traces has substantially the same width.*

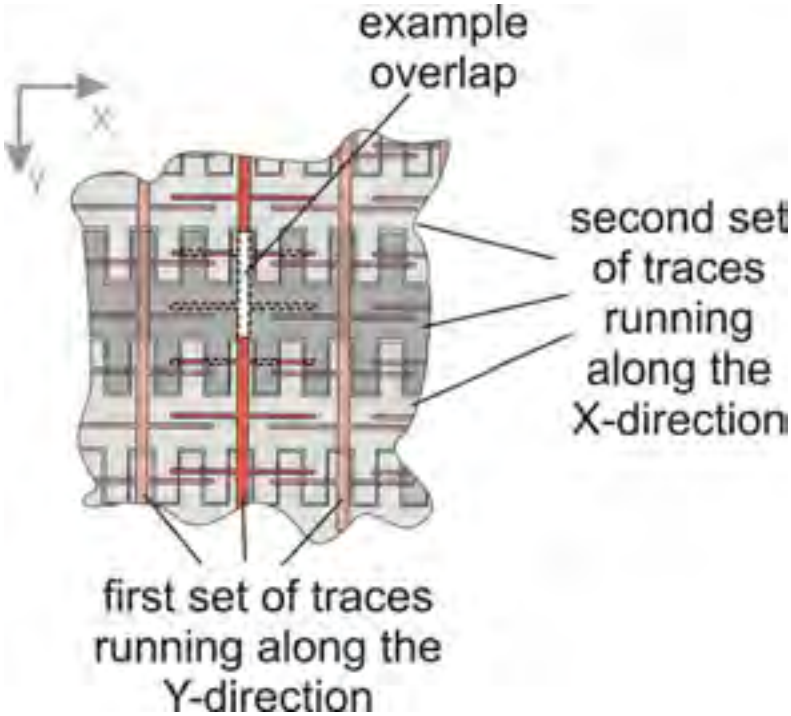


Figure. *Schematic representation of the Samsung Galaxy Tab 7.0 First and Second Set of Trace alignment. Note how the first set runs parallel to the Y-axis of a Cartesian grid and the second set runs parallel to the X-axis of a Cartesian grid.*

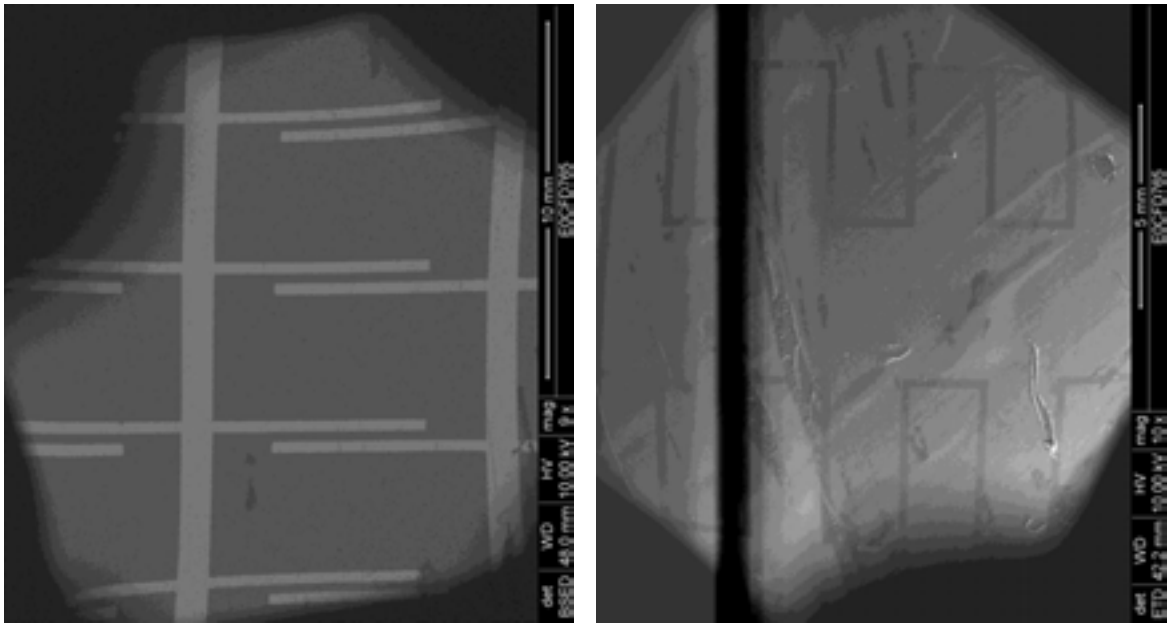


Figure. *Comparison of scanning electron micrographs of the first set of traces (left) and the second set of traces (right) in a Galaxy Tab 7.0 The traces are on different layers. See Exhibit D-15. Exhibit D-11.*

5. Claim 1: "wherein the minimum width of the second set of traces is substantially greater than the maximum width of the first set of traces at least at an intersection of the first and second sets of traces to provide shielding for the first set of traces"

140. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] conclude that those Apple products meet this limitation

because "the minimum width of the second set of traces is substantially greater than the maximum width of the first set of traces at least at an intersection of the first and second sets of traces to provide shielding for the first set of traces." All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in the first set of traces (the sense lines) have a maximum width that is less than the minimum width of the second set of traces (the drive lines). As explained by the inventors of the '129 Patent, Apple employed this configuration in its mobile devices to help shield the sense mechanisms from the electrical interference from the LCD.

141. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. In the capacitive touch sensor panel of the Samsung Galaxy Tab 10.1, the minimum width of the second set of traces is substantially greater than the maximum width of the first set of traces at least at an intersection of the first and second sets of traces to provide shielding for the first set of traces. More specifically, the width of the traces in the first set of traces is approximately 1.0 - 1.1 mm and the width of the traces in the second set of traces is approximately 5 mm (see Figure, above).

142. Further, the second set of traces provides shielding for the first set of traces, particularly from electrical noise generated by the underlying display. A detailed explanation of why the second set of conductive traces shield the first set of conductive traces follows.

143. Figure below shows the layer stack of the Samsung Galaxy Tab 10.1 and the relative distance of the different conductive trace layers from each other and the display.

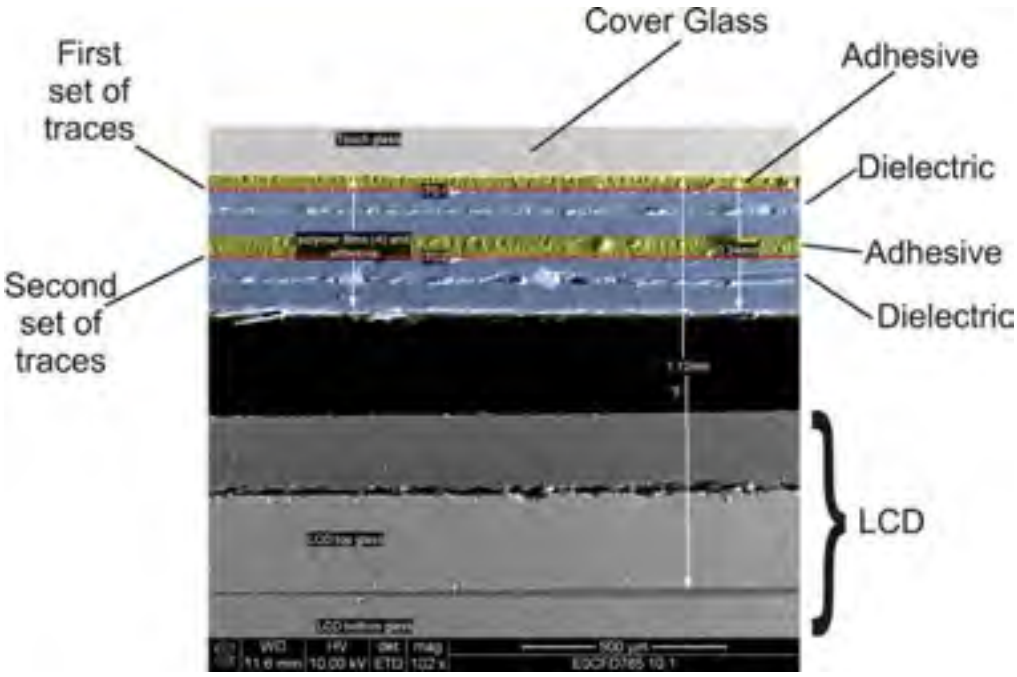


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing the various layers (and the distance between layers) detailed in the schematic illustration below. See Exhibit C-32.*

144. Wherever a trace on the first set of traces (top ITO layer) overlaps with a trace on the second set of traces (bottom ITO layer), mutual capacitance coupling occurs (Figure below).

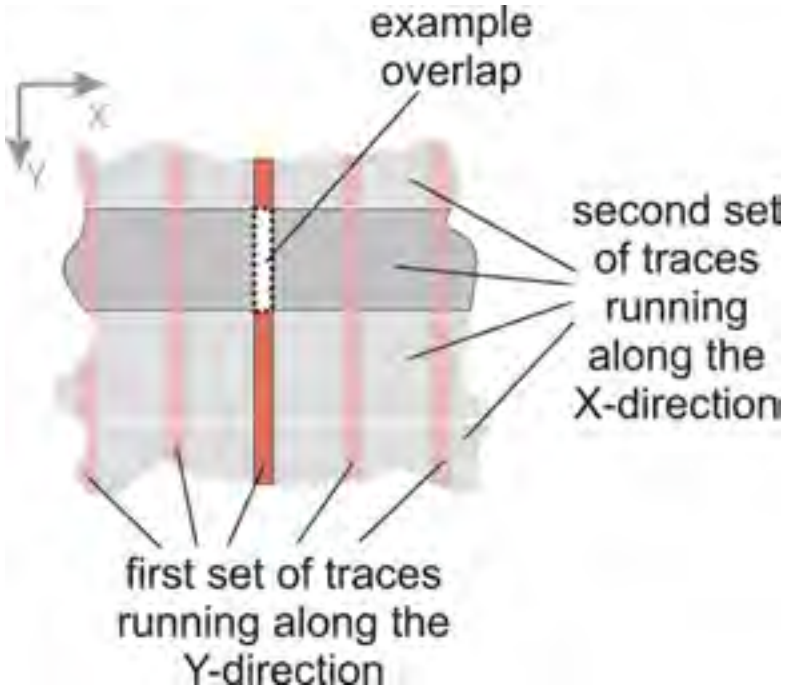


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in top view showing one example location where the overlap between the first set of traces and the second set of traces results in capacitive coupling.*

145. Likewise, at any location where either the first set of conductive traces or the second set of conductive traces overlaps with traces existing on the LCD display, mutual capacitance coupling occurs. The figure below illustrates this schematically, where both the mutual capacitance between the first and second conductive traces is shown as well as the coupling between traces on the LCD display and the first set of conductive traces (there is also coupling between the second set of traces and the LCD, but it is less relevant since the drive traces are driven by a low impedance, high current driver –and thus less susceptible to capacitive coupling; this detail is thus omitted from the drawing).

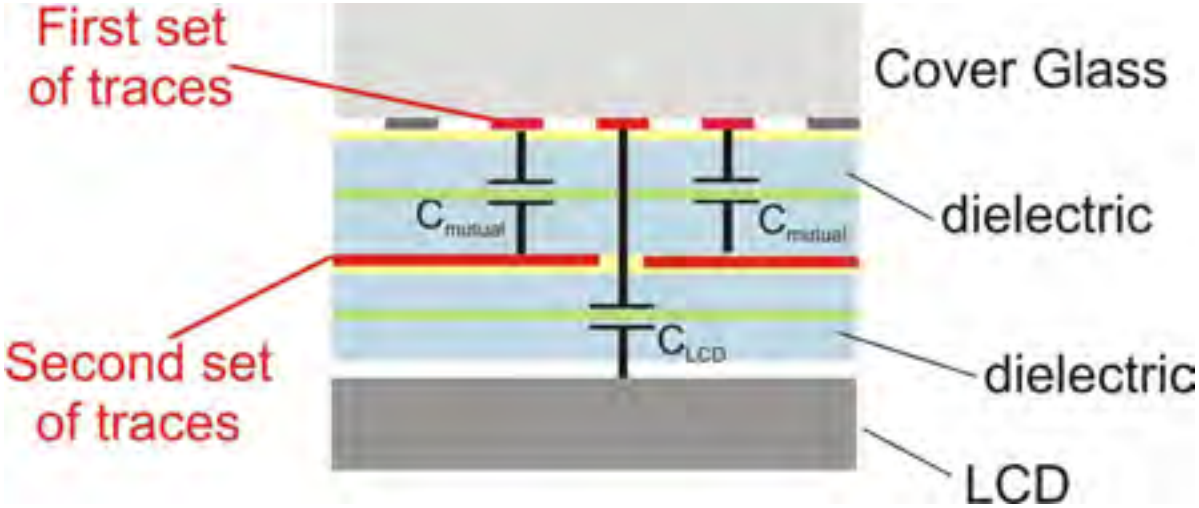


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in cross-section showing example locations where the overlap between the first set of traces, the second set of traces and traces on the LCD form areas of mutual capacitance.*

146. Note (as shown in the figure above) that capacitive coupling between any LCD traces and the first set of conductive traces can only occur through ***gaps*** between traces on the second conductive layer. Any conductive regions lying on a plane between the first traces and the LCD block electric field lines between the first set of conductive traces and the display traces. This is shown schematically below (not all fringing field lines are shown for clarity).

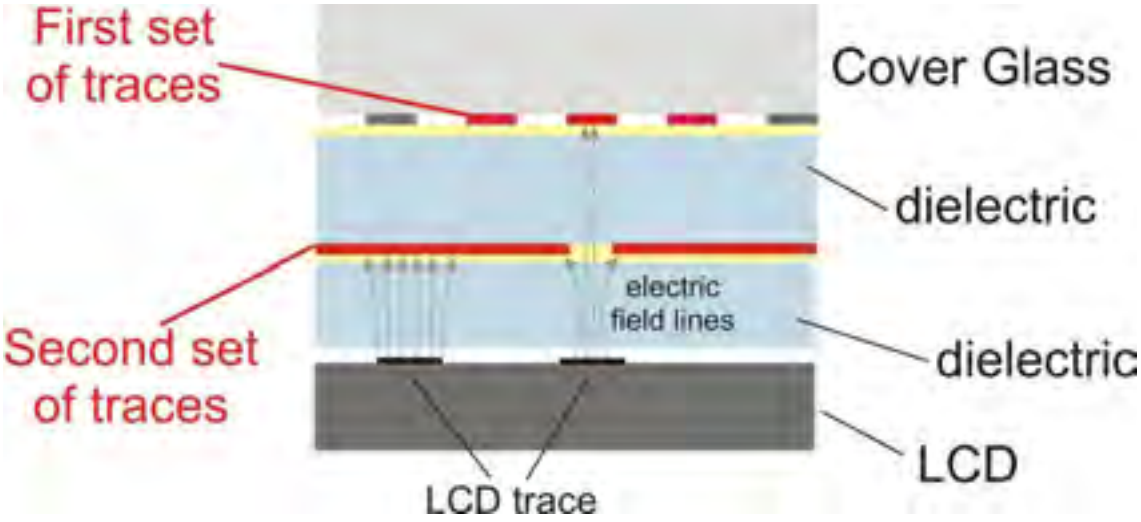
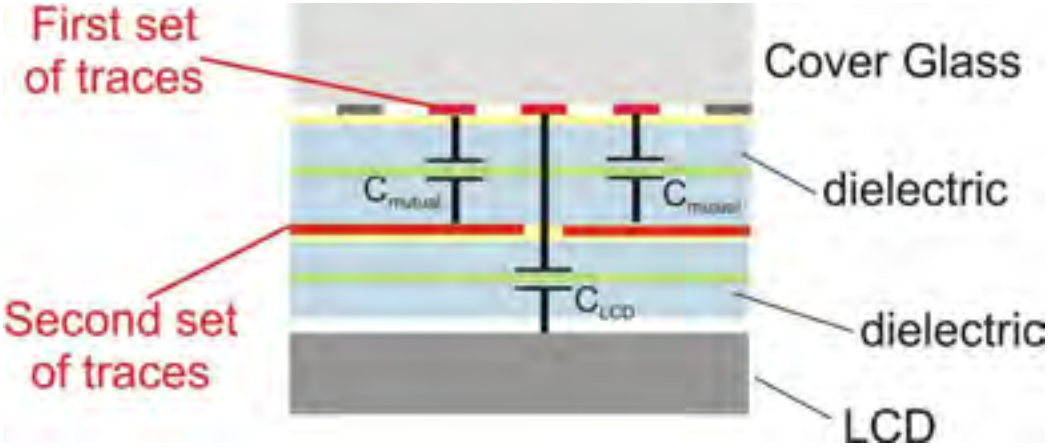
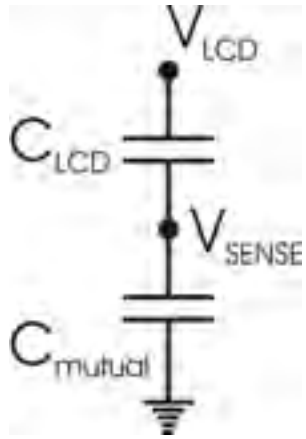


Figure. *Electric field lines can only extend between the LCD traces and the first set of traces via gaps in the second set of traces.*

147. We can calculate the shielding effect of the second set of traces as follows. (I refer to this below in my report as the "Shielding Calculations.") Consider the figure below.



Here, the mutual coupling between the first and second set of traces at a single node (*i.e.* overlap point) is represented by C_{mutual}. The mutual coupling between the first set of traces and active LCD traces (including the V_{COM} lines as well as any Control and Signal lines is represented by C_{LCD}. In the absence of the drive signal on the second set of traces, these capacitances can be represented by the following circuit.



Where V_{LCD} is the voltage amplitude (or max) on the LCD traces (*e.g.* the magnitude of the V_{COM} signal), V_{SENSE} would be the voltage seen on the first set of traces (the top, or sense, layer) and the two capacitance are as described above.

148. We can begin by estimating the value of C_{mutual} and C_{LCD} for two cases. *Case 1* is the case in which the second set of traces are as wide as the first set *(i.e.* the second set of traces are not widened and do not practice the teachings of the '129 patent). *Case 2* is the case in which the second set of traces are widened (as taught in the '129 patent). I will provide the analysis using the Samsung Galaxy Tab 10.1 dimensions; the conclusions are identical when using the slightly different Samsung Galaxy Tab 7.0 dimensions.

Case 1:

- Both sets of traces measure ~ 1 mm in width (*i.e.* both are as wide as the first set of traces in the Samsung Galaxy Tab 10.1)
- The overlap area between a first trace and a second trace is thus 1 mm x 1 mm, or 1 mm^2
- The vertical separation between the first and second set of traces is ~175 µm. This can be seen from the SEM cross-section of the Samsung Galaxy Tab 10.1 (Exhibit C) and is confirmed by the touchscreen stack shown for the Samsung Galaxy Tab 10.1 in SAMNDCA10890323.
- Neglecting fringing fields, we can estimate the capacitance using a parallel plate model as

$$C_{mutual} = \frac{\varepsilon A}{t} = \varepsilon \frac{1\ [mm^2]}{0.175\ [mm]} = 5.7\varepsilon\ [mm][\frac{F}{m}]$$

- The overlap area between a first trace and the LCD plane includes the *entire length* of one trace across the display on the first layer (217.4 mm) *minus* the area shielded by any first

layer traces (there are 42 first layer traces, each 1 mm wide). This is thus 1 mm x (217.4 mm - 42 x 1 mm).

- The vertical separation between the first traces and the display is 1 mm. This can be seen from the SEM cross-section of the Samsung Galaxy Tab 10.1 (Exhibit C).
- Neglecting fringing fields, we can estimate the capacitance using a parallel plate model as

$$C_{LCD} = \frac{\varepsilon A}{t} = \varepsilon \frac{1\,[mm] x (217.4\ mm - 42\ x\ 1\ mm)}{1\,[mm]} = 175.4\varepsilon\,[mm][\frac{F}{m}]$$

- We can estimate the voltage, V_{SENSE}, to first order from a capacitive divider (as per the figure above). Thus,

$$V_{Sense} = \left(\frac{C_{LCD}}{C_{mutual} + C_{LCD}}\right) V_{LCD} = \left(\frac{175.4}{5.7 + 175.4}\right) V_{LCD} = 0.96 V_{LCD}$$

- **Conclusion:** we can see that almost all of the V_{COM} voltage appears on the sense node. (Note: the *exact* amount will differ from this calculation because the various parasitics and returns to ground are ommitted in this analysis ([redacted] but this does not change the final conclusion of the argument, below).

Case 2:

- The first set of traces (top layer) are ~ 1 mm in width; the second set of traces (bottom layer) are 4.78 mm wide (as seen in the Samsung Galaxy Tab 10.1).
- The overlap area between a first trace and a second trace is thus 1 mm x 4.78 mm or 4.78 mm^2
- The vertical separation between the first and second set of traces is ~175 µm. This can be seen from the SEM cross-section of the Samsung Galaxy Tab 10.1 (Exhibit C) and is confirmed by the touchscreen stack shown for the Samsung Galaxy Tab 10.1 in SAMNDCA10890323.
- Neglecting fringing fields, we can estimate the capacitance using a parallel plate model as

$$C_{mutual} = \frac{\varepsilon A}{t} = \varepsilon \frac{4.78\,[mm^2]}{0.175\,[mm]} = 27.3\varepsilon\,[mm][\frac{F}{m}]$$

- The overlap area between a first trace and the LCD plane includes the *entire length* of one trace across the display on the first layer (217.4 mm) *minus* the area shielded by any first layer traces (there are 42 first layer traces, each 4.78 mm wide). This is thus 1 mm x (217.4 mm - 42 x 4.78 mm).
- The vertical separation between the first traces and the display is 1 mm. This can be seen from the SEM cross-section of the Samsung Galaxy Tab 10.1 (Exhibit C).
- Neglecting fringing fields, we can estimate the capacitance using a parallel plate model as

$$C_{LCD} = \frac{\varepsilon A}{t} = \varepsilon \frac{1\,[mm] x (217.4\ mm - 42\ x\ 4.78\ mm)}{1\,[mm]} = 16.4\varepsilon\,[mm][\frac{F}{m}]$$

- We can estimate the voltage, V_{SENSE}, to first order from a capacitive divider (as per the figure above). Thus,

$$V_{Sense} = \left(\frac{C_{LCD}}{C_{mutual} + C_{LCD}}\right) V_{LCD} = \left(\frac{16.4}{27.3 + 16.4}\right) V_{LCD} = 0.37 V_{LCD}$$

- **Conclusion:** the wider second set of traces now shield the first set, drastically reducing the coupling capacitance, C_{LCD}, when compared to Case 1 and, thus, reducing the undesired voltage seen on the sense traces (V_{SENSE}).

149. This specific analysis can be modified to include the equivalent impedances of the various traces, the relative dielectric permittivities of the layers or even modifications due to fringing fields but the ***basic conclusion will always be the same***: wider traces in the bottom layer reduce the value of the mutual capacitance coupling between any lines on the LCD and the sense traces (*i.e.* the top or first set of traces). The smaller the gap between traces on the second set (*i.e.* the wider the traces), the better this shielding.

150. In the capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 the minimum width of the second set of traces is substantially greater than the maximum width of the first set of traces at least at an intersection of the first and second sets of traces to provide shielding for the first set of traces. More specifically, the width of the traces in the first set of traces is approximately 1 mm and the width of the traces in the second set of traces is approximately 4.2 mm.

151. Further, the second set of traces provides shielding for the first set of traces, particularly from electrical noise generated by the underlying display. A detailed explanation of why the second set of conductive traces shield the first set of conductive traces follows.

152. Figure below shows the layer stack of the Samsung Galaxy Tab 7.0 and the relative distance of the different conductive trace layers from each other and the display.

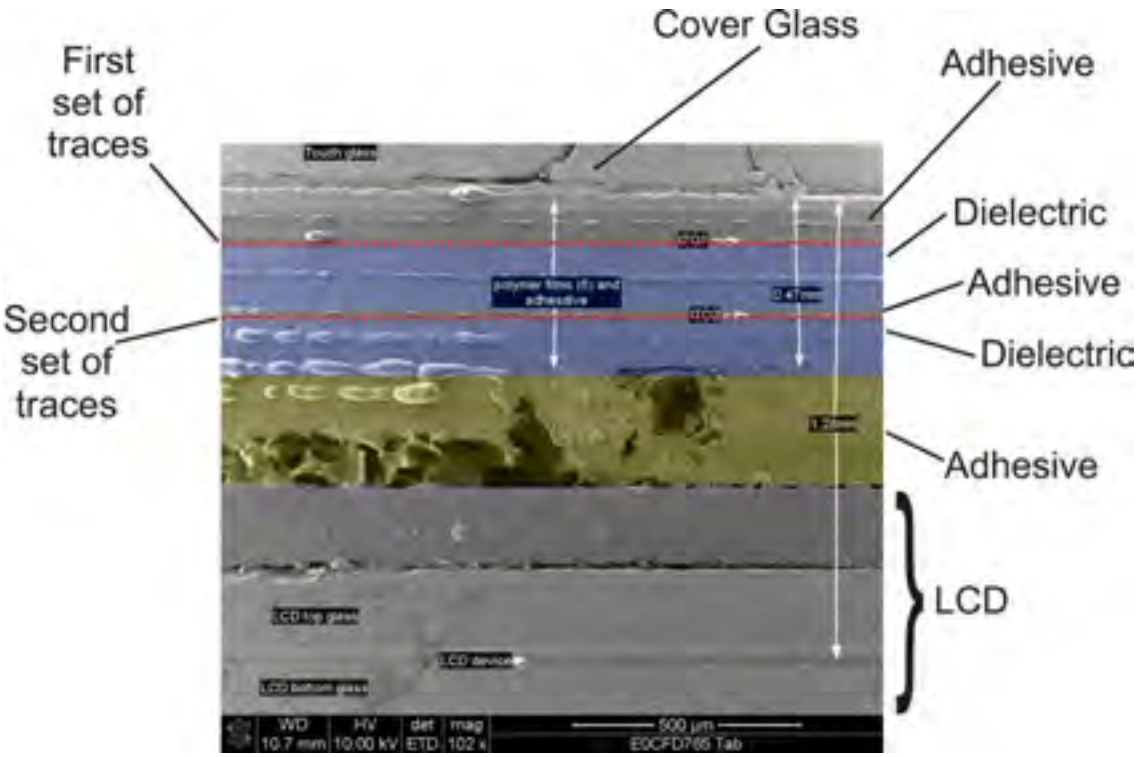


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing the various layers (and the distance between layers) detailed in the schematic illustration below. See Exhibit D-27.*

153. Wherever a trace on the first set of traces (top ITO layer) overlaps with a trace on the second set of traces (bottom ITO layer), mutual capacitance coupling occurs (Figure below).

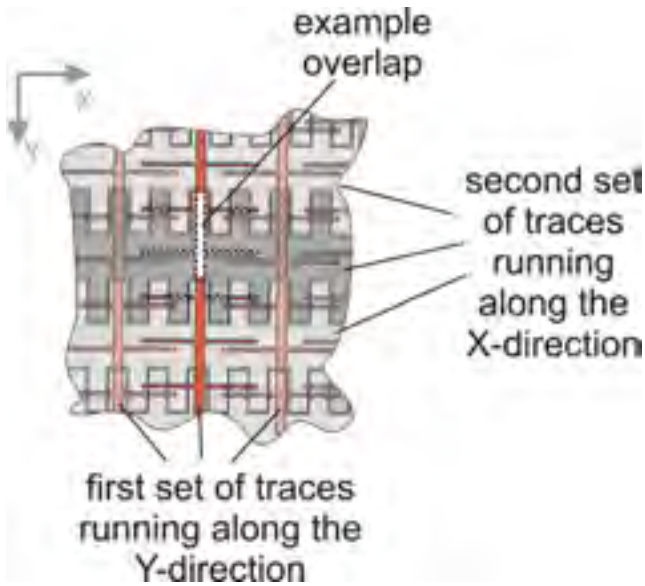


Figure. *Schematic representations of a Samsung Galaxy Tab 7.0 touch panel in top view showing one example location where the overlap between the first set of traces and the second set of traces results in capacitive coupling.*

154. Likewise, at any location where either the first set of conductive traces or the second set of conductive traces overlaps with traces existing on the LCD display, mutual capacitance coupling occurs. The figure below illustrates this schematically, where both the mutual capacitance between the first and second conductive traces is shown as well as the coupling between traces on the LCD display and the first set of conductive traces (there is also coupling between the second set of traces and the LCD, but it is less relevant since the drive traces are driven by a low impedance, high current driver –and thus less susceptible to capacitive coupling; this detail is thus omitted from the drawing).

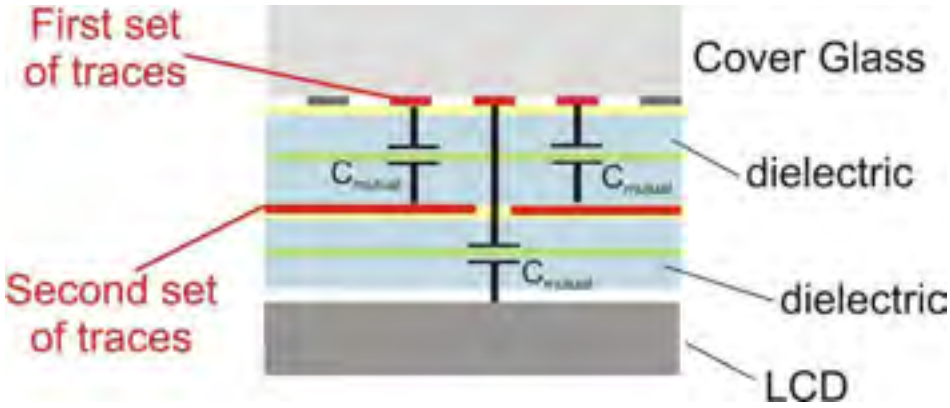


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touch panel in cross-section showing example locations where the overlap between the first set of traces, the second set of traces and traces on the LCD form areas of mutual capacitance..*

155. Note (as shown above), that capacitive coupling between any LCD traces and the first set of conductive traces can only occur through any ***gaps*** between traces on the second conductive layer. Any conductive regions lying on a plane between the first traces and the LCD block electric field lines between the first set of conductive traces and the display traces. This is shown schematically below. This results in the shielding effect noted above in my Shielding Calculations.

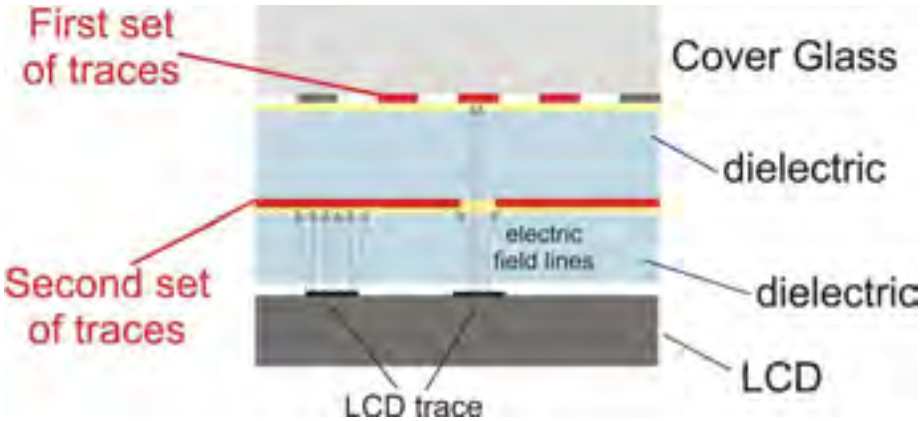


Figure. *Electric field lines can only extend between the LCD traces and the first set of traces via gaps in the second set of traces.*

6. Claim 1: "wherein sensors are formed at locations at which the first set of traces intersects with the second set of traces while separated by the dielectric."

156. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted]. I conclude that those Apple products meet this limitation because "wherein sensors are formed at locations at which the first set of traces intersects with the second set of traces while separated by the dielectric." All of the Apple products I examined use a mutual capacitance sensing method in which sensors are formed at the intersections of the first set of traces and the second set of traces, which are separated by a dielectric.

157. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. In the capacitive touch sensor panel of the Samsung Galaxy 10.1, sensors are formed at locations where the first set of traces intersects with the second set of traces while separated by the dielectric. Specifically, the Samsung Galaxy Tab 10.1 uses a touchscreen based on mutual

capacitance, in which capacitive touch sensors are formed at each intersection of the two sets of traces (see Figure below). As also shown below, the first and second sets of traces are separated by a plastic dielectric.

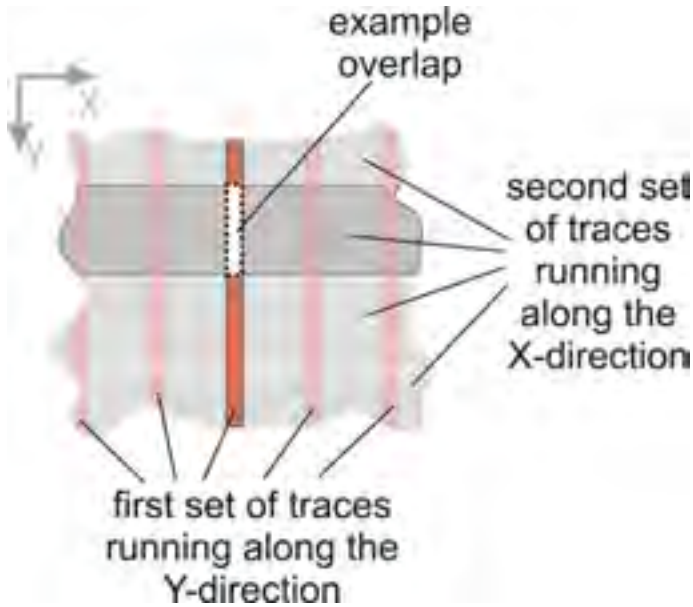


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in top view showing one example location where the overlap between the first set of traces and the second set of traces results in a mutual capacitive touch sensor.*

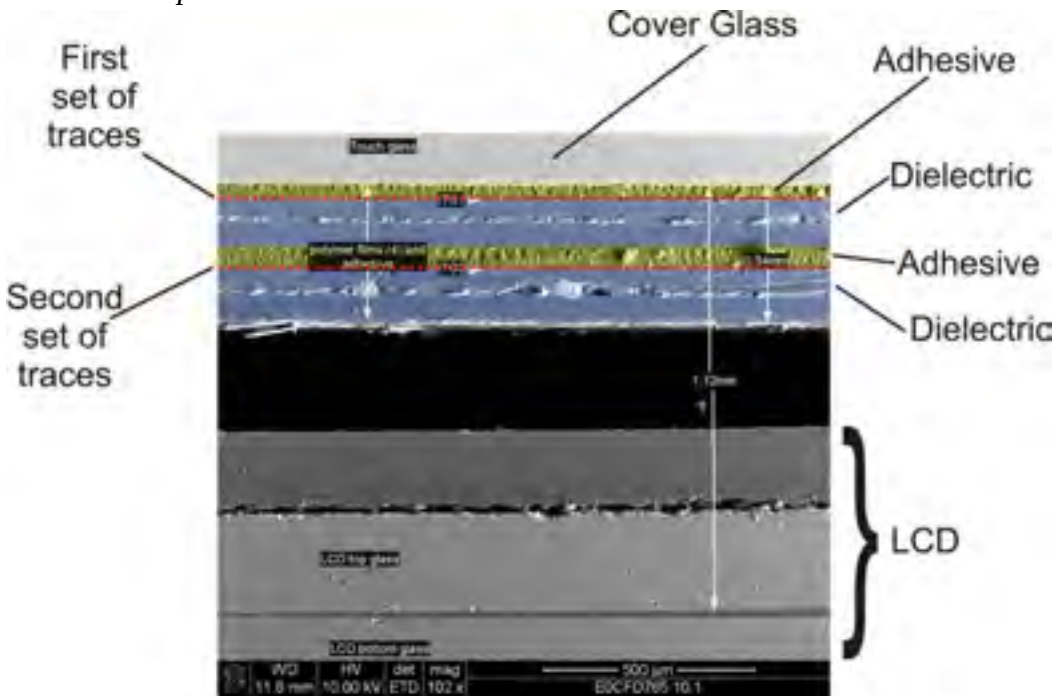


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit C-32.*

158. In the capacitive touch sensor panel of the Samsung Galaxy Tab 7.0, sensors are formed at locations where the first set of traces intersects with the second set of traces while separated by the dielectric. Specifically, the Samsung Galaxy Tab 7.0 uses a touchscreen based on mutual capacitance, in which capacitive touch sensors are formed at each intersection of the two sets of traces (see Figure below). As also shown below, the first and second sets of traces are separated by a plastic dielectric.

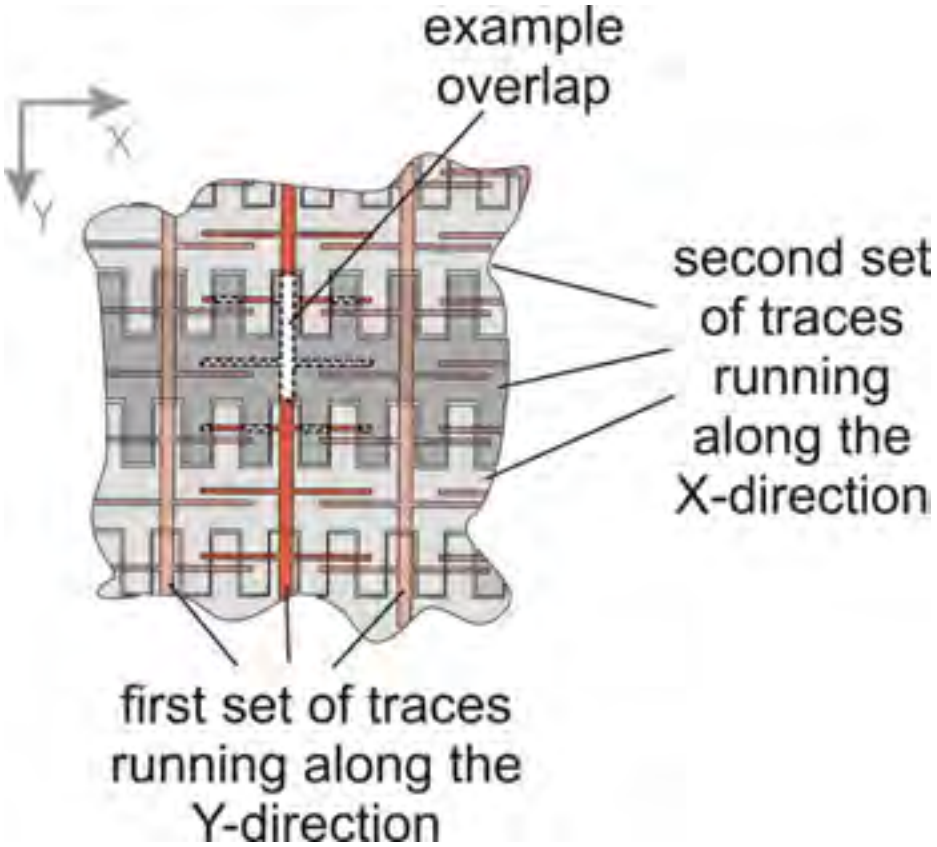


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touch panel in top view showing one example location where the overlap between the first set of traces and the second set of traces results in a mutual capacitive touch sensor.*

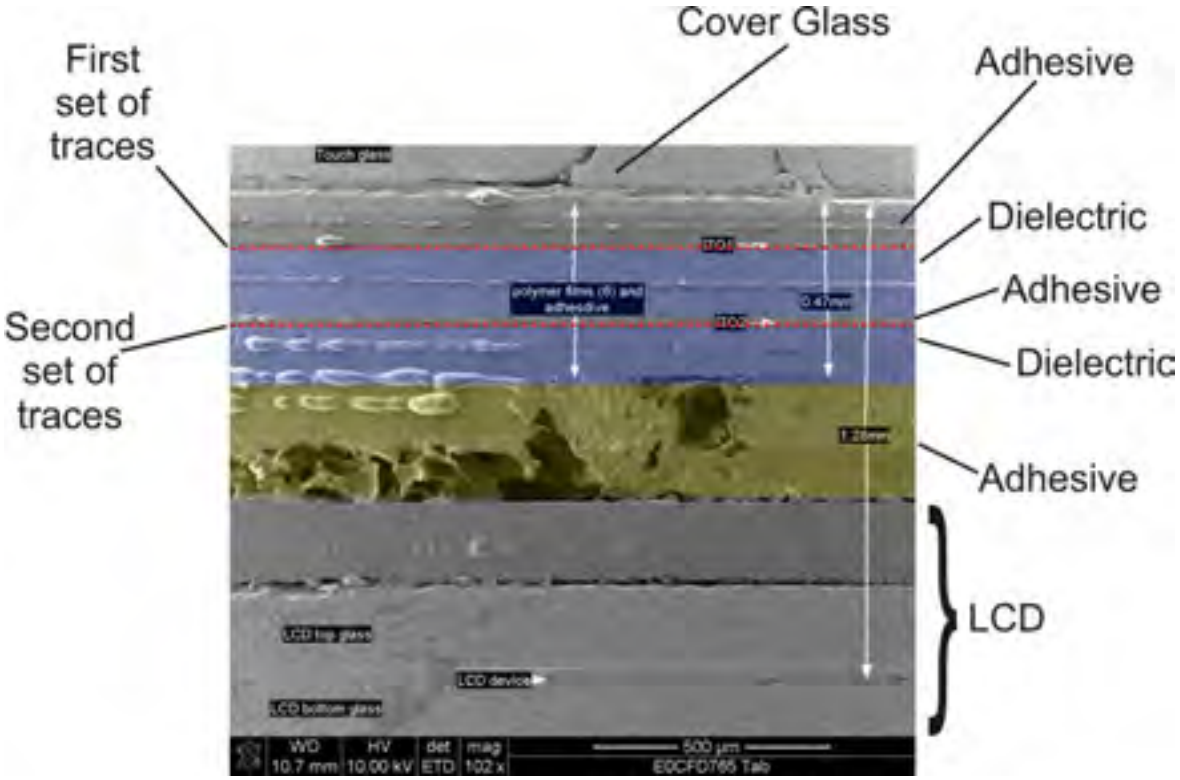


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit D-27.*

159. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 1 of the ’129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

7. Claim 3: "The capacitive touch sensor panel of claim 1, wherein the second set of traces are widened to substantially electrically isolate the first set of traces from a liquid crystal display (LCD)."

160. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because in the Apple "capacitive touch sensor panel . . . the second set of traces are widened to substantially electrically isolate the first set of traces from a liquid crystal display (LCD)." As noted above, the second set of traces (drive lines) are widened for the purpose of substantially electrically isolating the first set of traces (sense lines) from the LCD. That is why they are widened and I have determined that the electrical isolation they provide is substantial. This results in the shielding effect noted above in my Shielding Calculations.

161. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The second set of traces in the capacitive touch sensor panel of the Samsung Galaxy Tab 10.1 are widened to substantially electrically isolate the first set of traces from a liquid crystal display (LCD). More specifically, the Samsung Galaxy Tab 10.1 contains a 10.1-inch WXGA TFT (PLS) LCD touchscreen. (*See, e.g.*, APLNDC-Y0000060376.) As set forth above under the detailed infringement analysis for Claim 1, the second set of traces are located between the LCD and the first set of traces, and are widened to a width of approximately 5 mm to electrically isolate the first set of traces from the device's LCD.

162. The second set of traces in the capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 are widened to substantially electrically isolate the first set of traces from a liquid crystal display (LCD). More specifically, the Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. (*See, e.g.*, APLNDC-Y0000063879.) As set forth above under the detailed

infringement analysis for Claim 1, the second set of traces are located between the LCD and the first set of traces, and are widened to a width of 4.2 mm to electrically isolate the first set of traces from the device's LCD.

163. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 3 of the '129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

8. Claim 5: "The capacitive touch sensor panel of claim 1, further comprising a computing system that incorporates the sensor panel."

164. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because the Apple "capacitive touch sensor panel" in each further includes "a computing system that incorporates the sensor panel." Each of the Apple iPhone and iPad products I examined included a microprocessor and other computing components, such as memory, which is a computing system. This is self-evident from the functionality of the devices, which compute inputs, present content, and run millions of possible computer program applications, from Angry Birds to iTunes.

165. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 and Samsung

Galaxy 10.1 include a computing system that incorporates the sensor panel. More specifically, they each contains a microprocessor, such as the dual-core Tegra 2 processor, and other computing components, such as memory, and is therefore a computing system. (*See, e.g.*, http://www.samsung.com/us/mobile/galaxy-tab/SCH-I905UWAVZW-features, accessed 8 March 2012: "The central processing unit is the world's first mobile super chip – the NVIDIA® Tegra™ 2 dual core 1 GHz processor, to run all your functions and apps effortlessly.") (APLNDC-Y0000234098—4104 at APLNDC-Y0000234099.)

166. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 5 of the '129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

9. Claim 7: "The capacitive touch sensor panel of claim 5, further comprising a digital audio player that incorporates the computing system."

167. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because the "capacitive touch sensor panel" in each further includes "a digital audio player that incorporates the computing system." Each of the Apple iPhone and iPad products I examined included a digital audio player that incorporates a microprocessor and other computing components, such as memory, which is a computing system. This is self-evident from the

functionality of the devices, which compute inputs, downloads music and other digital audio content, and play a nearly infinite library of music through Apple's proprietary iTunes audio management and Apple's iTunes Store.

168. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of these devices further comprises a digital audio player that incorporates the computing system. More specifically, the Galaxy Tab 10.1 and Galaxy Tab 7.0 play music and other audio files (using Windows Media Player, for example) and therefore comprise a digital audio player. (*See, e.g.*, APLNDC-Y0000060377; APLNDC-Y0000060436-446; APLNDC-Y0000065323; APLNDC-Y0000065355-56; APLNDC-Y0000065957-59; APLNDC-Y0000063927-932.)

169. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 8 of the '129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

10. Claim 9 Preamble: "A digital audio player having a capacitive touch sensor panel, the touch sensor panel comprising"

170. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because they include "A digital audio player having a capacitive touch sensor panel, the touch

sensor panel." Indeed, all of the Apple products I examined included a touch sensor that is based upon measurement or detection of capacitive coupling. In addition, each of the Apple iPhone and iPad products I examined included a digital audio player that incorporates a microprocessor and other computing components, such as memory, which is a computing system. This is self-evident from the functionality of the devices, which compute inputs, downloads music and other digital audio content, and play a nearly infinite library of music through Apple's proprietary iTunes audio management and Apple's iTunes Store.

171. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 10.1 and Galaxy Tab 7.0 comprise a digital audio player having a capacitive touch sensor panel. More specifically, the Galaxy Tab 10.1 contains a 10.1-inch WXGA TFT (PLS) LCD touchscreen. (*See, e.g.*, APLNDC-Y0000060376.) The Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. This is described and shown in Samsung Galaxy Tab User 7.0 Manual at APLNDC-Y0000063879. Further, the Galaxy Tab 10.1 and Galaxy Tab 7.0 play digital music and other audio files and therefore comprise a digital audio player. (See, e.g., APLNDC-Y0000060377; APLNDC-Y0000060436-446; APLNDC-Y0000065323; APLNDC-Y0000065355-56; APLNDC-Y0000065957-59; APLNDC-Y0000063927-932.)

11. Claim 9: "a first set of traces of conductive material arranged along a first dimension of a two-dimensional coordinate system, the first set of traces having one or more widths including a maximum width; and"

172. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because "a first set of traces of conductive material arranged along a first dimension of a two-

dimensional coordinate system, the first set of traces having one or more widths including a maximum width." All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in the first set of traces (the sense lines) have a maximum width that is less than the minimum width of the second set of traces (the drive lines).

173. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of the Samsung Galaxy Tab 10.1 contains a first set of traces of conductive material arranged along a first dimension of a two-dimensional coordinate system, the first set of traces having one or more widths including a maximum width. Specifically, the first set of traces is composed of a conductive material and oriented along one dimension (the X axis in the figures below) of a Cartesian grid. As illustrated in the figure below, each of the first set of traces has substantially the same width – a maximum width along their entire lengths.

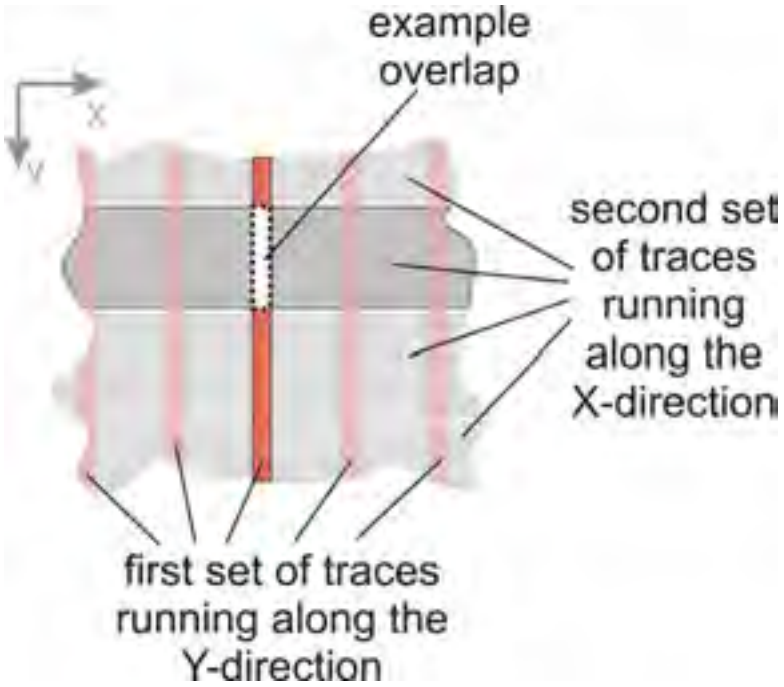


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in top view showing how the first and second set of traces are arranged along perpendicular axes of a Cartesian grid.*

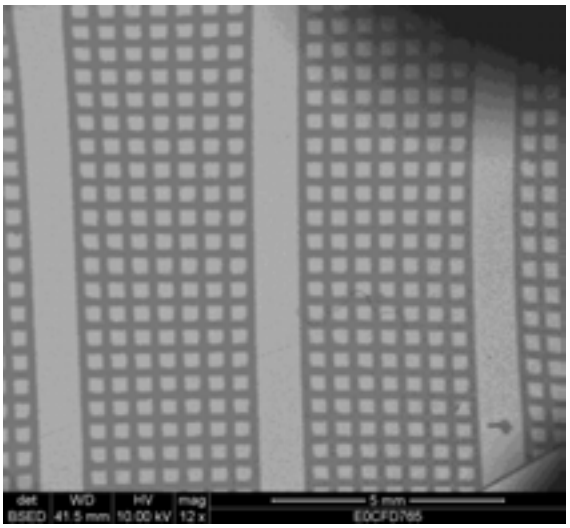


Figure. *Scanning electron micrograph of the first set of traces of the Galaxy 10.1 Tab showing how the electrodes are oriented parallel to one axis on a Cartesian grid. Moreover, each of the first set of traces has substantially the same width. See Exhibit C-15.*

174. The capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 contains a first set of traces of conductive material arranged along a first dimension of a two-dimensional coordinate system, the first set of traces having one or more widths including a maximum width. Specifically, the first set of traces is composed of a conductive material and oriented along one dimension (the X axis in the figures below) of a Cartesian grid. As illustrated in the figure below, each of the first set of traces has substantially the same width – a maximum width along their entire lengths.

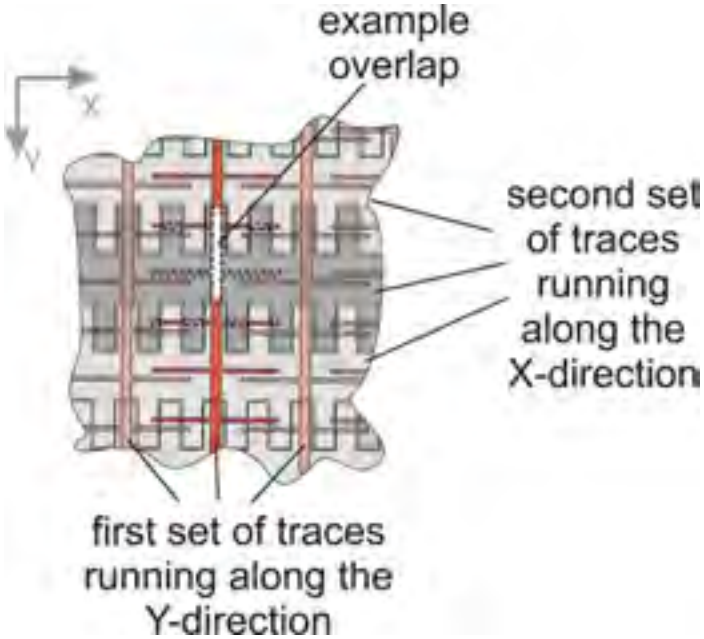


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touch panel in top view showing how the first and second set of traces are arranged along perpendicular axes of a Cartesian grid.*

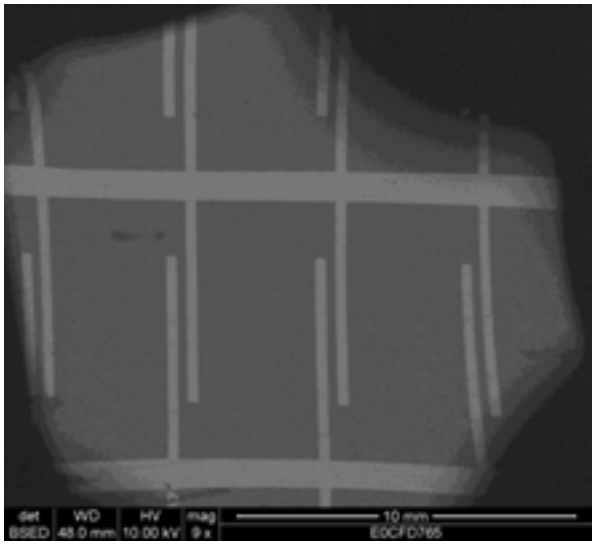


Figure. *Scanning electron micrograph of the first set of traces of the Galaxy Tab 7.0 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. Moreover, each of the first set of traces has substantially the same width. See Exhibit D-15.*

12. Claim 9: "a second set of traces of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system, the second set of traces having one or more widths including a minimum width;"

175. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because they include "a second set of traces of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-

dimensional coordinate system, the second set of traces having one or more widths including a minimum width." All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in the first set of traces (the sense lines) have a maximum width that is less than the minimum width of the second set of traces (the drive lines).

176. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of the Samsung Galaxy Tab 10.1 contains a second set of traces of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system, the second set of traces having one or more widths including a minimum width. More specifically, the second set of traces is composed of a conductive material and oriented along a second dimension (see Figure, below) of a Cartesian grid. As shown below, each of the second set of traces has substantially the same width – a minimum width along their entire length.

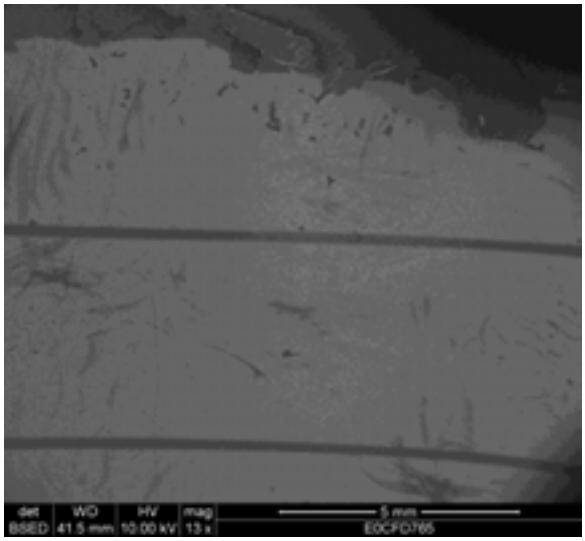


Figure. *Scanning electron micrograph of the second set of traces showing how the electrodes are oriented parallel to one axis on a Cartesian grid. Moreover, each of the first set of traces has substantially the same width. See Exhibit C-48.*

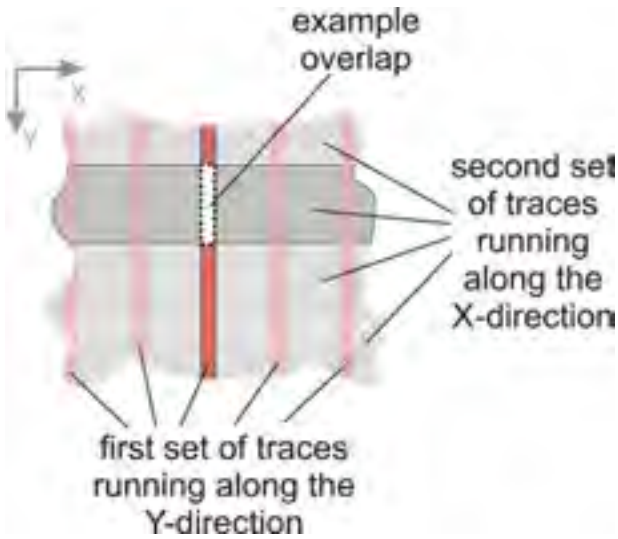


Figure. *Schematic representation of the Samsung Galaxy Tab 10.1 First and Second Set of Trace alignment. Note how the first set runs parallel to the X-axis of a Cartesian grid and the second set runs parallel to the Y-axis of a Cartesian grid.*

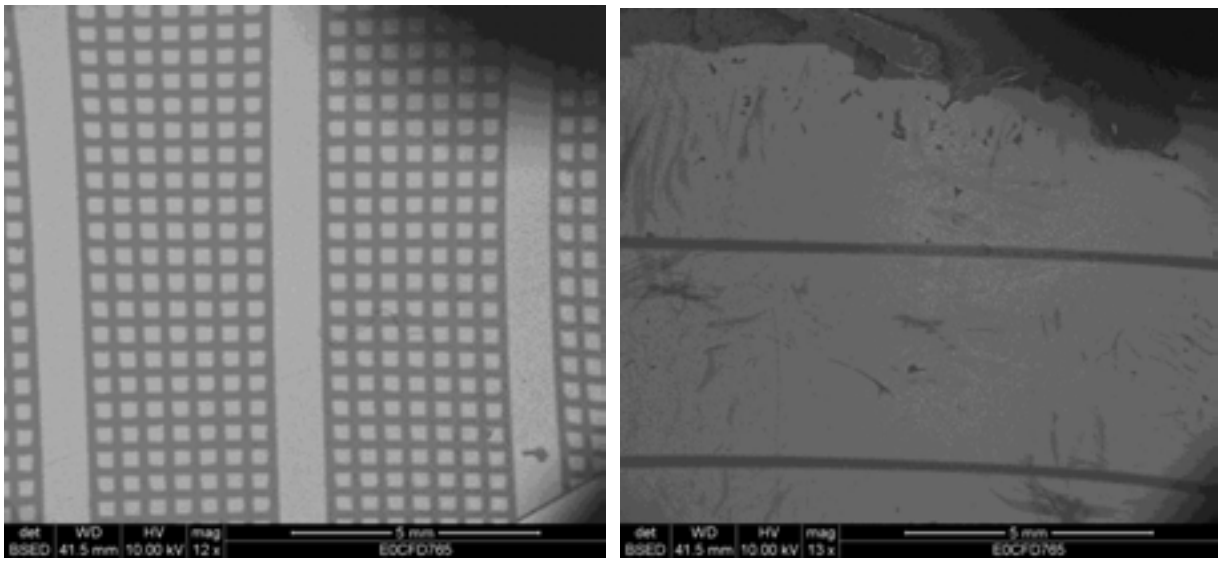


Figure. *Comparison of scanning electron micrographs of the first set of traces (left) and the second set of traces (right). See Exhibit C-15 and Exhibit C-48. The traces are on different layers.*

177. The capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 contains a second set of traces of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system, the

second set of traces having one or more widths including a minimum width. More specifically, the second set of traces is composed of a conductive material and oriented along a second dimension (see Figure, below) of a Cartesian grid. As shown below, each of the second set of traces has substantially the same width – a minimum width along their entire length.

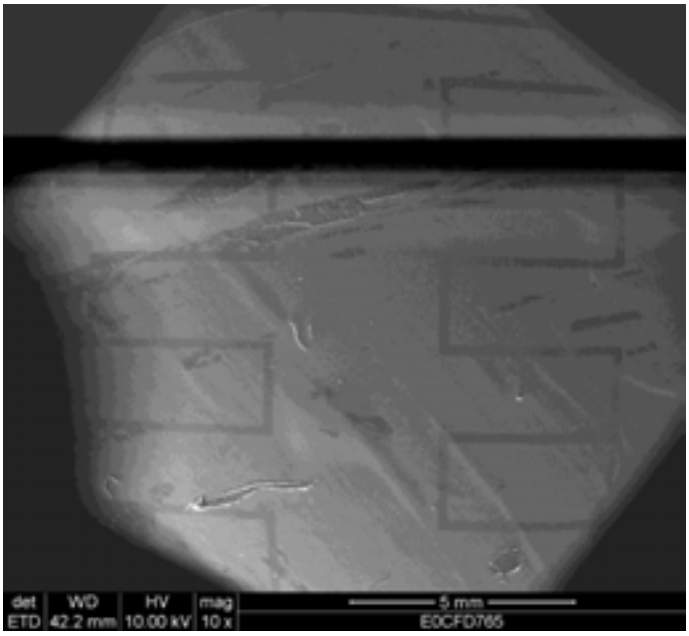


Figure. *Scanning electron micrograph of the second set of traces in a Galaxy Tab 7.0 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. Moreover, each of the first set of traces has substantially the same width. See Exhibit D-11.*

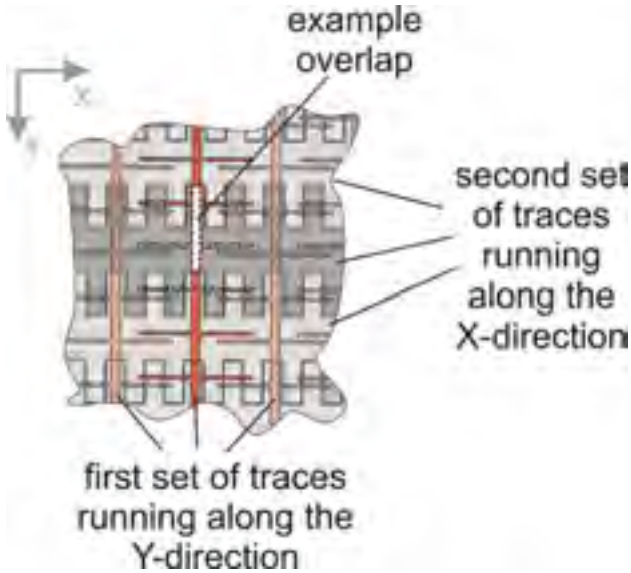


Figure. *Schematic representation of the Samsung Galaxy Tab 7.0 First and Second Set of Trace alignment. Note how the first set runs parallel to the X-axis of a Cartesian grid and the second set runs parallel to the Y-axis of a Cartesian grid.*

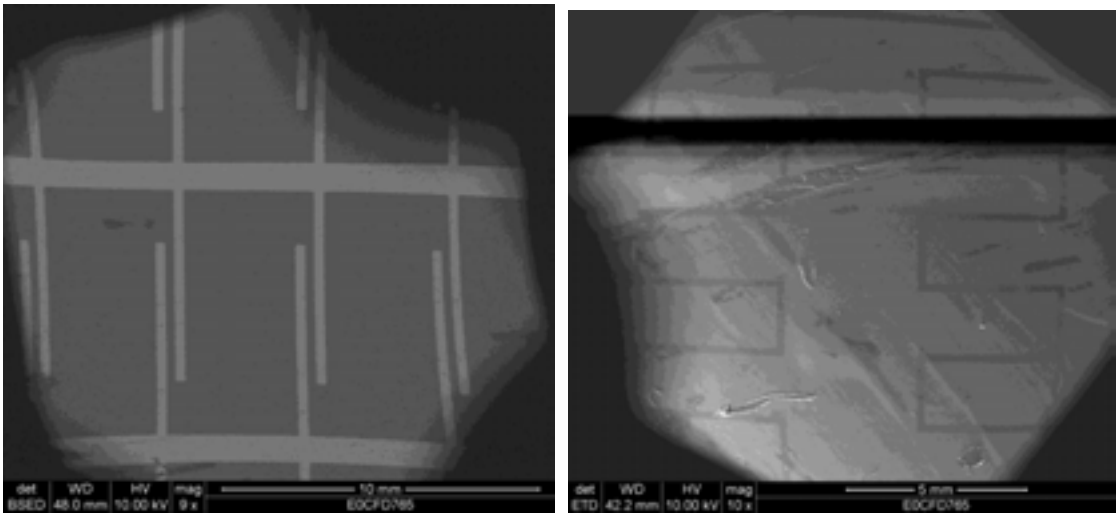


Figure. *Comparison of scanning electron micrographs of the first set of traces (left) and the second set of traces (right) in a Galaxy Tab 7.0 The traces are on different layers. See Exhibit D-15 and Exhibit D-11.*

13. Claim 9: "wherein the minimum width of the second set of traces is substantially greater than the maximum width of the first set of traces at least at an intersection of the first and second sets of traces to provide shielding for the first set of traces"

178. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because "the minimum width of the second set of traces is substantially greater than the maximum width of the first set of traces at least at an intersection of the first and second sets of

traces to provide shielding for the first set of traces." All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in the first set of traces (the sense lines) have a maximum width that is less than the minimum width of the second set of traces (the drive lines). As explained by the inventors of the '129 Patent, Apple employed this configuration in its mobile devices to help shield the sense mechanisms from the electrical interference from the LCD.

179. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. In the capacitive touch sensor panel of the Samsung Galaxy Tab 10.1, the minimum width of the second set of traces is substantially greater than the maximum width of the first set of traces at least at an intersection of the first and second sets of traces to provide shielding for the first set of traces. More specifically, the width of the traces in the first set of traces is approximately 1.0 - 1.1 mm and the width of the traces in the second set of traces is approximately 5 mm (see Figure, above).

180. Further, the second set of traces provides shielding for the first set of traces, particularly from electrical noise generated by the underlying display. A detailed explanation of why the second set of conductive traces shield the first set of conductive traces follows.

181. Figure below shows the layer stack of the Samsung Galaxy Tab 10.1 and the relative distance of the different conductive trace layers from each other and the display.

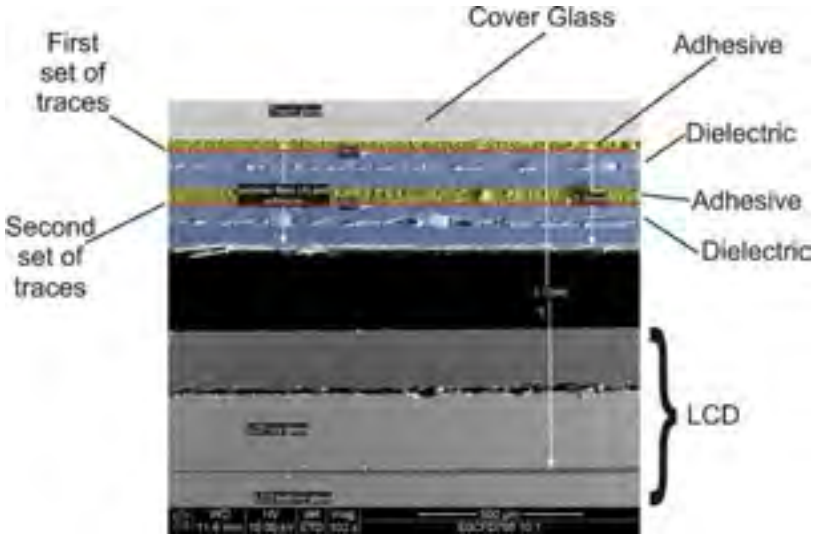


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing the various layers (and the distance between layers) detailed in the schematic illustration below. See Exhibit C-32.*

182. Wherever a trace on the first set of traces (top ITO layer) overlaps with a trace on the second set of traces (bottom ITO layer), mutual capacitance coupling occurs (Figure below).

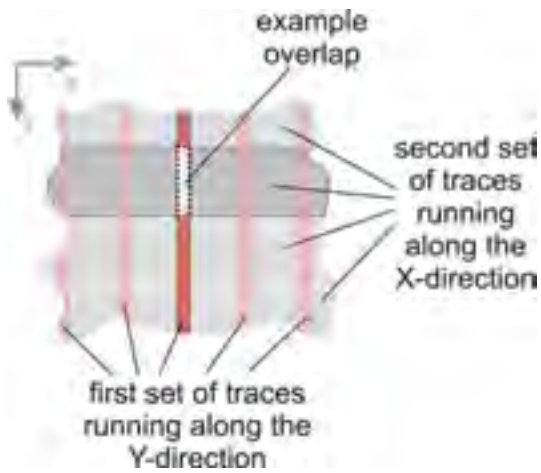


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in top view showing one example location where the overlap between the first set of traces and the second set of traces results in capacitive coupling.*

183. Likewise, at any location where either the first set of conductive traces or the second set of conductive traces overlaps with traces existing on the LCD display, mutual capacitance coupling occurs. The figure below illustrates this schematically, where both the mutual capacitance between the first and second conductive traces is shown as well as the coupling between traces on the LCD display and the first set of conductive traces (there is also coupling between the second set of traces and the LCD, but it is less relevant since the drive traces are driven by a low impedance, high current driver –and thus less susceptible to capacitive coupling; this detail is thus omitted from the drawing).

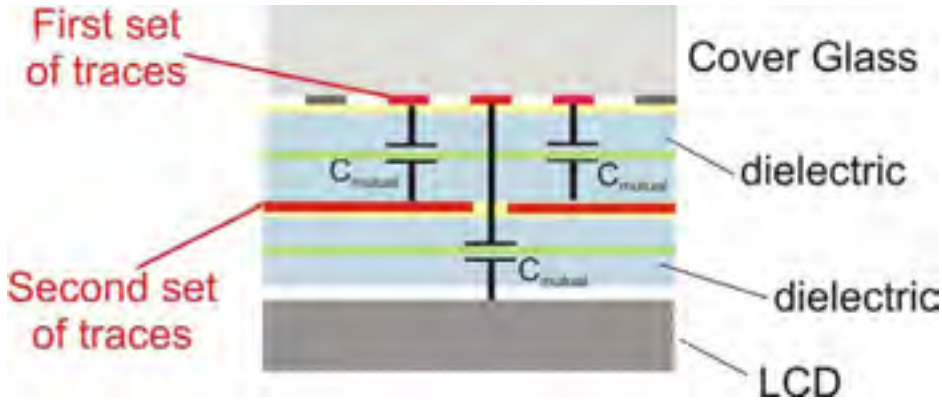


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in cross-section showing example locations where the overlap between the first set of traces, the second set of traces and traces on the LCD form areas of mutual capacitance..*

184. Note, as shown above, that capacitive coupling between any LCD traces and the first set of conductive traces can only occur through any ***gaps*** between traces on the second conductive layer. Any conductive regions lying on a plane between the first traces and the LCD block electric field lines between the first set of conductive traces and the display traces. This is shown schematically below. This results in the shielding effect noted above in my Shielding Calculations.

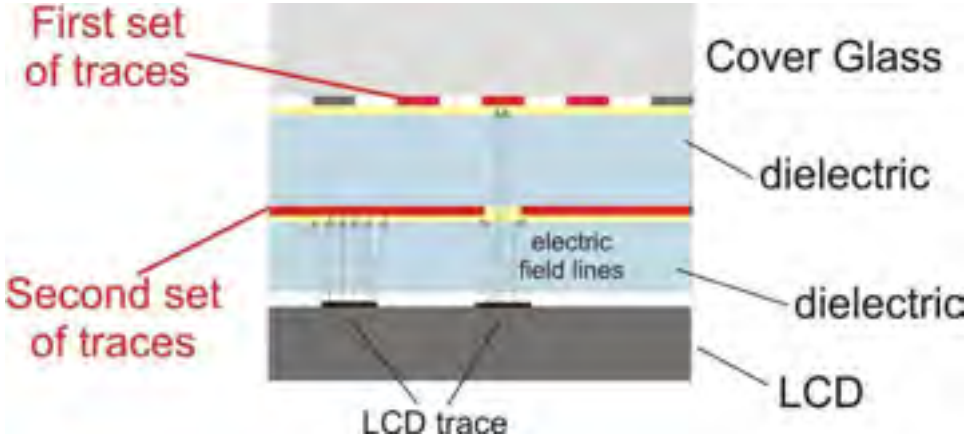


Figure. *Electric field lines can only extend between the LCD traces and the first set of traces via gaps in the second set of traces.*

185. In the capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 the minimum width of the second set of traces is substantially greater than the maximum width of the first set of traces at least at an intersection of the first and second sets of traces to provide shielding for the first set of traces. More specifically, the width of the traces in the first set of traces is approximately 1 mm and the width of the traces in the second set of traces is approximately 4.2 mm.

186. Further, the second set of traces provides shielding for the first set of traces, particularly from electrical noise generated by the underlying display. A detailed explanation of why the second set of conductive traces shield the first set of conductive traces follows.

187. Figure below shows the layer stack of the Samsung Galaxy Tab 7.0 and the relative distance of the different conductive trace layers from each other and the display.

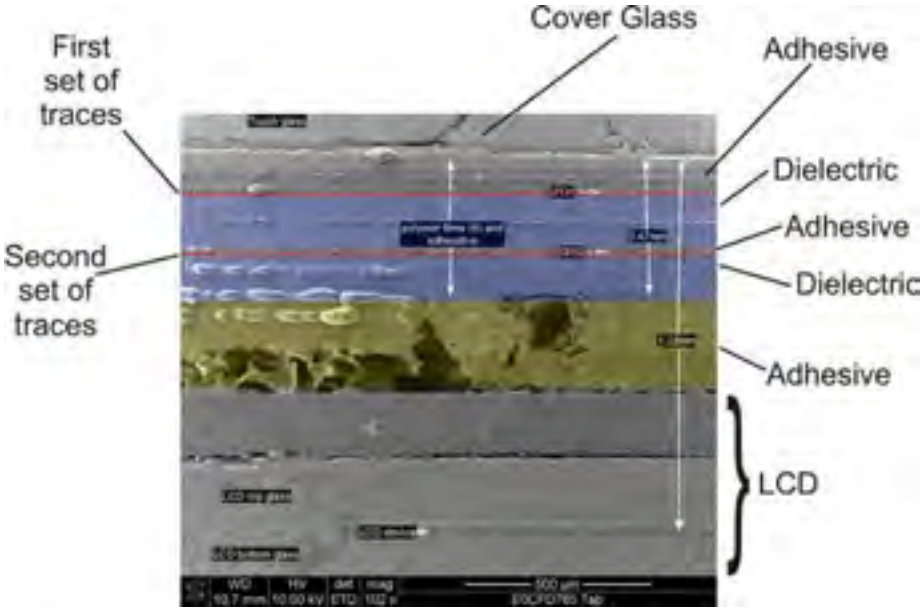


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing the various layers (and the distance between layers) detailed in the schematic illustration below. See Exhibit D-27.*

188. Wherever a trace on the first set of traces (top ITO layer) overlaps with a trace on the second set of traces (bottom ITO layer), mutual capacitance coupling occurs (Figure below).

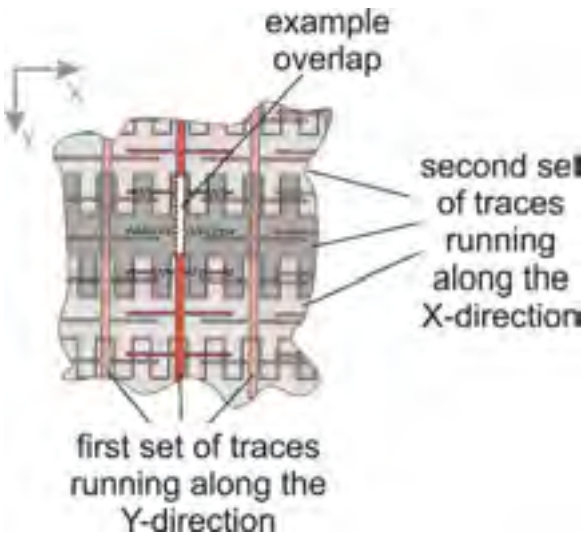


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touch panel in top view showing one example location where the overlap between the first set of traces and the second set of traces results in capacitive coupling.*

189. Likewise, at any location where either the first set of conductive traces or the second set of conductive traces overlaps with traces existing on the LCD display, mutual capacitance coupling occurs. The figure below illustrates this schematically, where both the mutual capacitance between the first and second conductive traces is shown as well as the coupling between traces on the LCD display and the first set of conductive traces (there is also coupling between the second set of traces and the LCD, but it is less relevant since the drive traces are driven by a low impedance, high current driver –and thus less susceptible to capacitive coupling; this detail is thus omitted from the drawing).

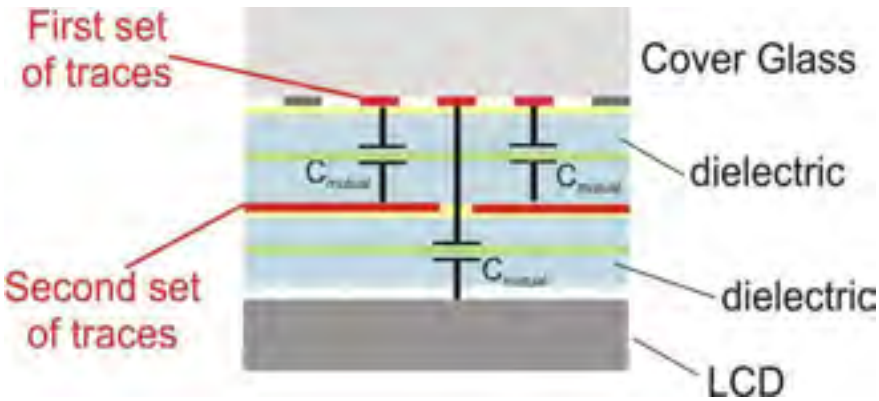


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in cross-section showing example locations where the overlap between the first set of traces and the second set of traces form areas of mutual capacitance..*

190. Note, as shown above, that capacitive coupling between any LCD traces and the first set of conductive traces can only occur through any ***gaps*** between traces on the second conductive layer. Any conductive regions lying on a plane between the first traces and the LCD block electric field lines between the first set of conductive traces and the display traces. This is shown schematically below. This results in the shielding effect noted above in my Shielding Calculations.

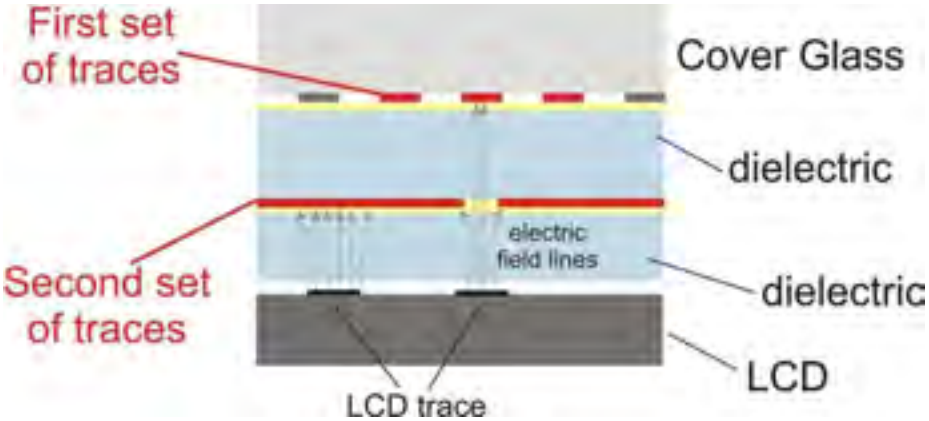


Figure. *Electric field lines can only extend between the LCD traces and the first set of traces via gaps in the second set of traces.*

14. Claim 9: "wherein sensors are formed at locations at which the first set of traces intersects with the second set of traces while separated by the dielectric."

191. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted]

[redacted] I conclude that those Apple products meet this limitation because "wherein sensors are formed at locations at which the first set of traces intersects with the second set of traces while separated by the dielectric." All of the Apple products I examined use a mutual capacitance sensing method in which sensors are formed at the intersections of the first set of traces and the second set of traces, which are separated by a dielectric.

192. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. In the capacitive touch sensor panel of the Samsung Galaxy 10.1, sensors are formed at locations where the first set of traces intersects with the second set of traces while separated by the dielectric. Specifically, the Samsung Galaxy Tab 10.1 uses a touchscreen based on mutual capacitance, in which capacitive touch sensors are formed at each intersection of the two sets of traces (see Figure below). As also shown below, the first and second sets of traces are separated by a plastic dielectric.

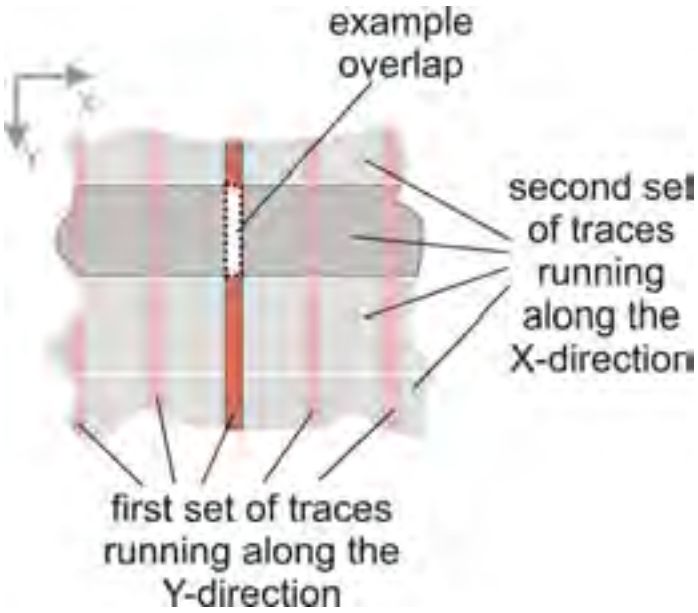


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in top view showing one example location where the overlap the first and second set of traces results in a mutual capacitive touch sensor.*

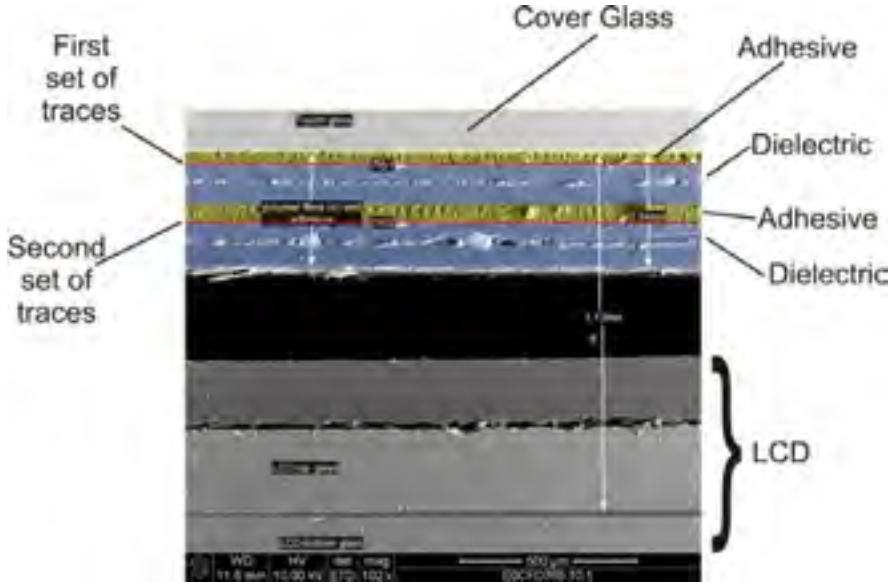


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit C-32.*

193. In the capacitive touch sensor panel of the Samsung Galaxy Tab 7.0, sensors are formed at locations where the first set of traces intersects with the second set of traces while separated by the dielectric. Specifically, the Samsung Galaxy Tab 7.0 uses a touchscreen based on mutual capacitance, in which capacitive touch sensors are formed at each intersection of the two sets of traces (see Figure below). As also shown below, the first and second sets of traces are separated by a plastic dielectric.

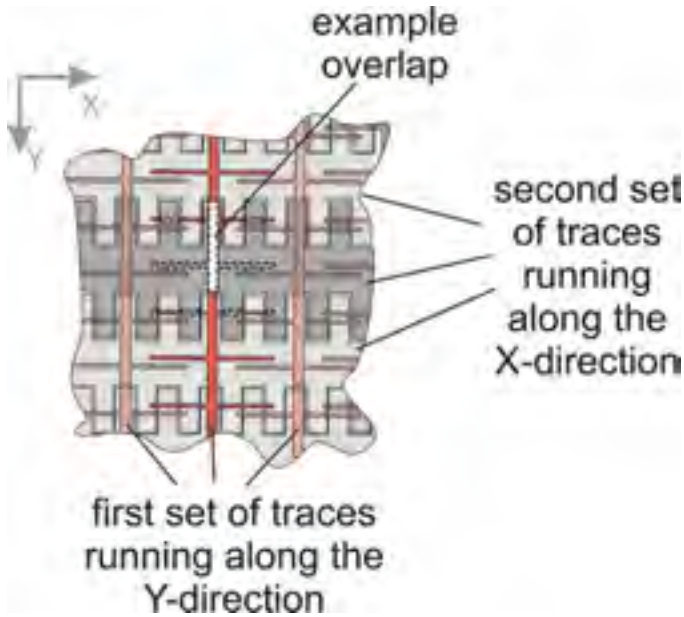


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touch panel in top view showing one example location where the overlap between the first set of traces and the second set of traces results in a mutual capacitive touch sensor.*

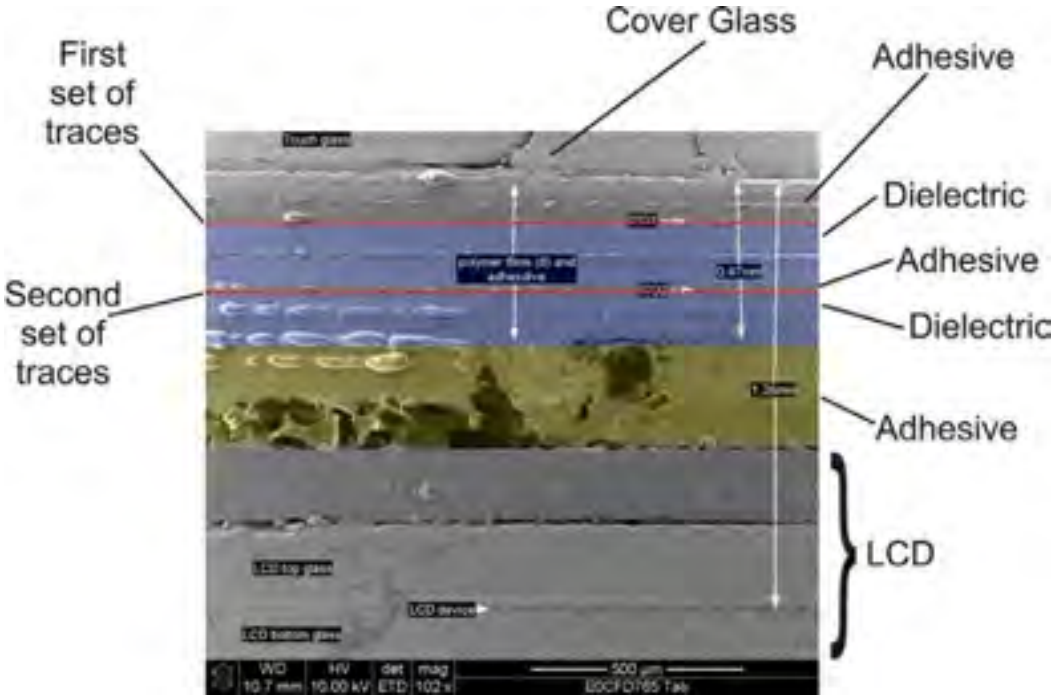


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit D-27.*

194. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 9 of the ’129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

15. Claim 10 Preamble: “A capacitive touch sensor panel”

195. I have spoken to the named-inventors of the ’129 Patent claims who were working on designs for Apple’s products when they conceived of their invention and I have examined the

various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because they include "A capacitive touch sensor panel." Indeed, all of the Apple products I examined included a touch sensor that is based upon measurement or detection of capacitive coupling.

196. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 10.1 has a capacitive touch sensor panel. Specifically, the Galaxy Tab 10.1 contains a 10.1-inch WXGA TFT (PLS) LCD touchscreen. (*See, e.g.*, Tab 10.1 User Manual at APLNDC-Y0000060376.). The Samsung Galaxy Tab 7.0 has a capacitive touch sensor panel. The Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. This is described and shown in Samsung Galaxy Tab User 7.0 Manual. APLNDC-Y0000063879.

16. Claim 10: "sense traces having one or more widths including a maximum width"

197. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted]. I conclude that those Apple products meet this limitation because they include "sense traces having one or more widths including a maximum width." All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-

dimensional coordinate system where in the first set of traces (the sense lines) have a maximum width that is less than the minimum width of the second set of traces (the drive lines).

198. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of the Samsung Galaxy Tab 10.1 contains a first set of traces of conductive material arranged along a first dimension of a two-dimensional coordinate system, the first set of traces having one or more widths including a maximum width. In the Samsung Galaxy Tab 10.1, this first set of conductive material is connected to detection circuitry such that the traces on this first set of conductive material act as *sense* traces. (See above, for example, description concerning claim 1 ("whereas" clause) of the '607 Patent.) Specifically, the first set of traces is composed of a conductive material and oriented along one dimension (the Y axis in the figures below) of a Cartesian grid. As illustrated in the figure below, each of the first set of traces has substantially the same width – a maximum width along their entire lengths.

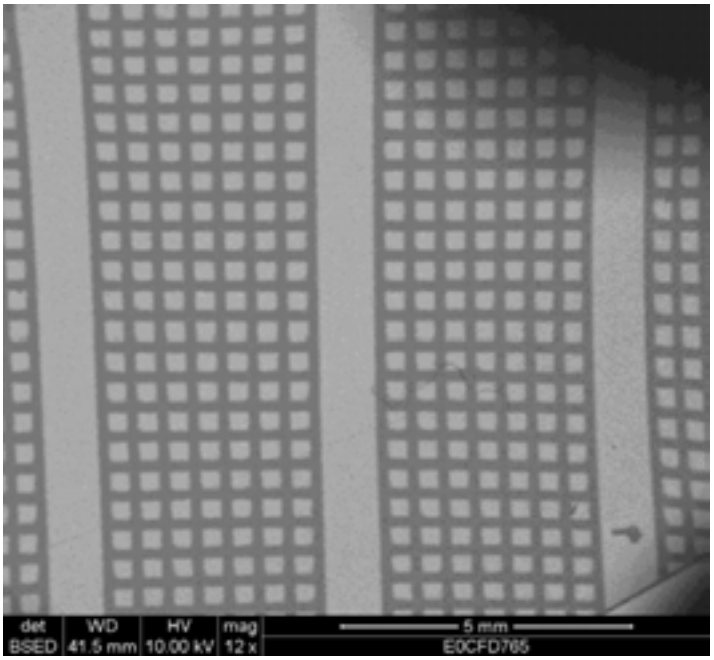


Figure. *Scanning electron micrograp of the first set of traces showing how the electrodes are oriented parallel to one axis on a Cartesian grid. Moreover, each of the first set of traces has substantially the same width. See Exhibit C-15.*

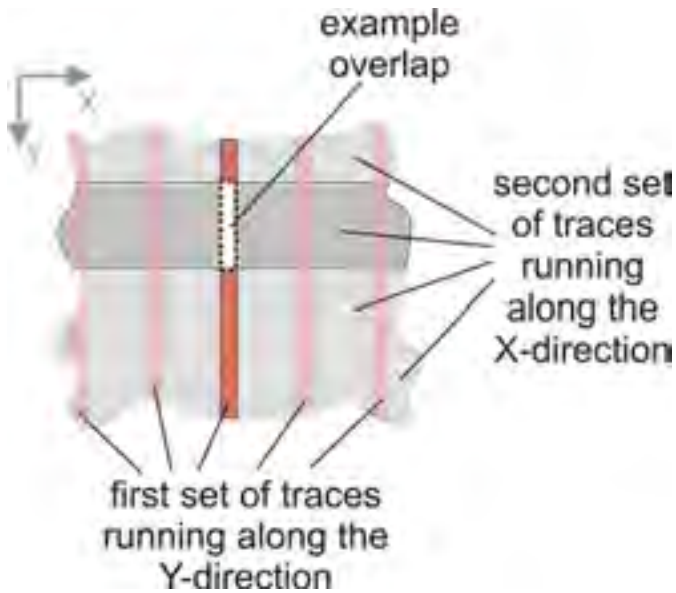


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in top view showing one exampe location where the overlap the first and second set of traces results in a mutual capacitive touch sensor.*

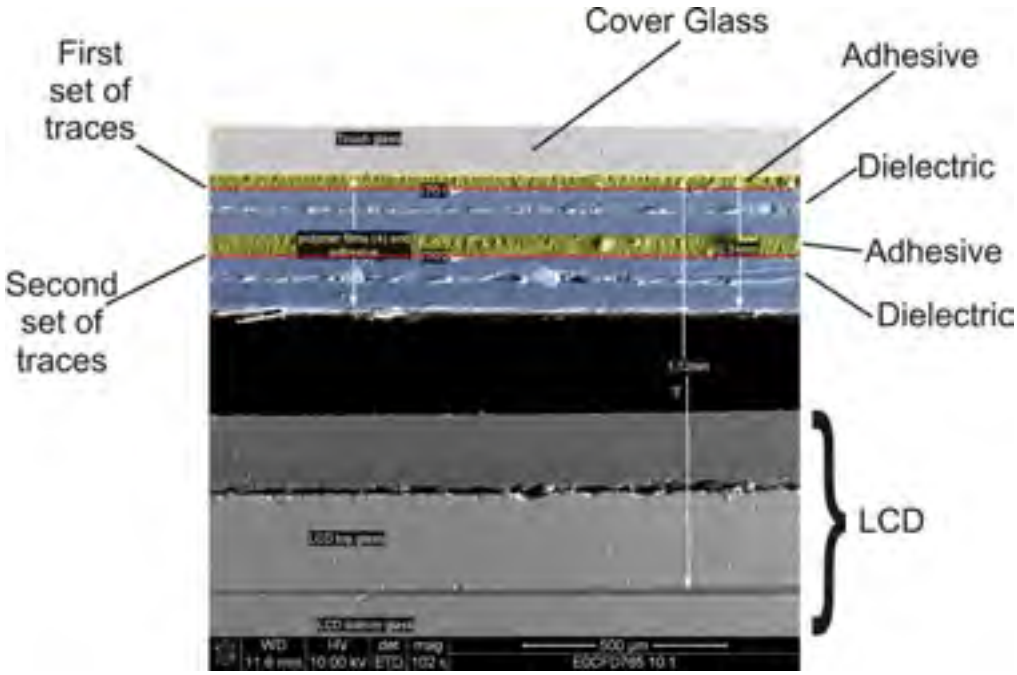


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit C-32.*

199. The capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 contains a first set of traces of conductive material arranged along a first dimension of a two-dimensional coordinate system, the first set of traces having one or more widths including a maximum width. In the Samsung Galaxy Tab 7.0, this first set of conductive material is connected to detection circuitry such that the traces on this first set of conductive material act as *sense* traces. (See above, for example, description concerning claim 1 ("whereas" clause) of claim 1 of the '607 Patent.) Specifically, the first set of traces is composed of a conductive material and oriented along one dimension (the Y axis in the figures below) of a Cartesian grid. As illustrated in the figure below, each of the first set of traces has substantially the same width – a maximum width along their entire lengths.

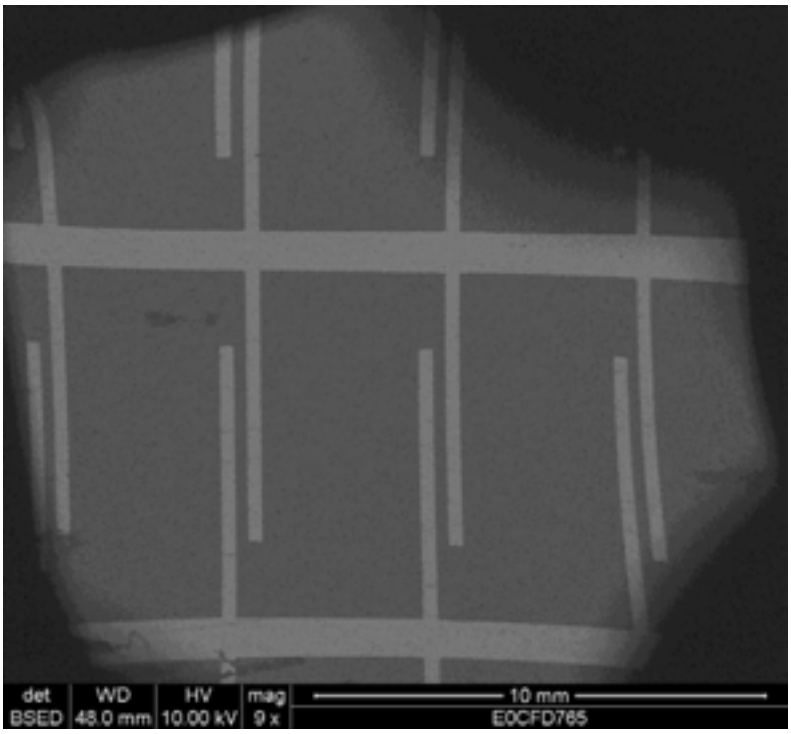


Figure. *Scanning electron micrograph of the first set of traces (running horizontally) in a Galaxy Tab 7.0 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. Moreover, each of the first set of traces has substantially the same width. (See Exhibit D-15.)*

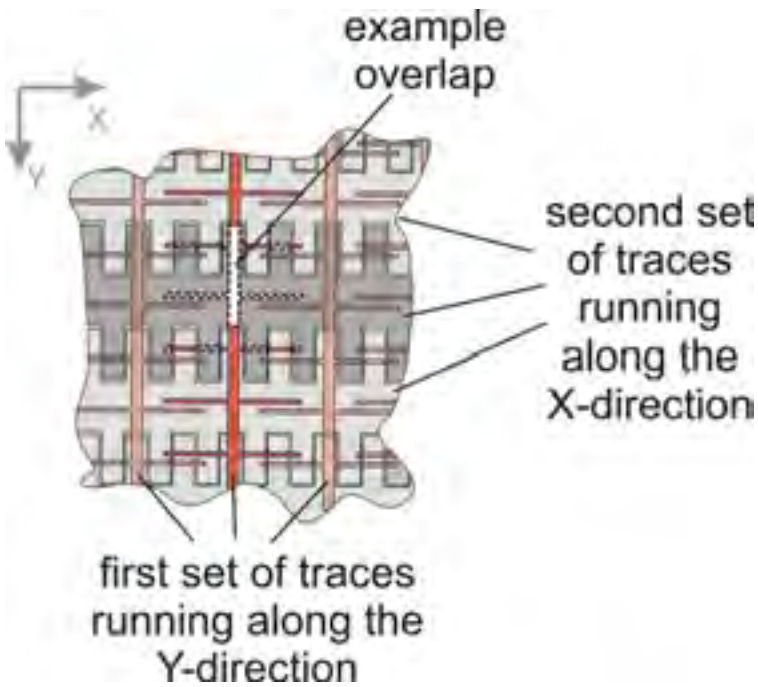


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touch panel in top view showing one example location where the overlap between the first set of traces and the second set of traces results in a mutual capacitive touch sensor.*

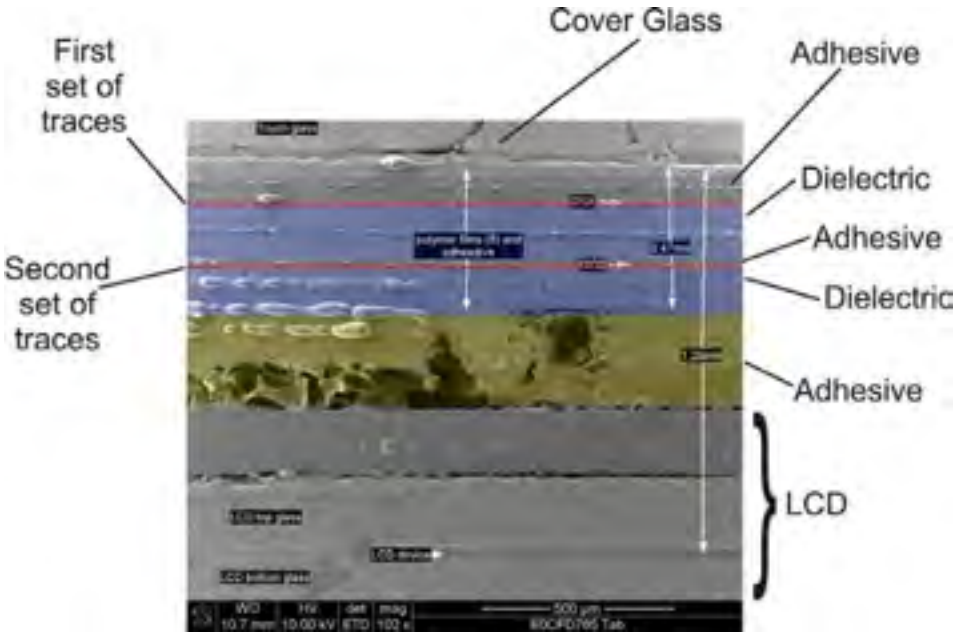


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit D-27.*

17. Claim 10: "drive traces spatially separated from the sense traces by a dielectric, the drive traces having one or more widths including a minimum width, the minimum width of the drive traces being substantially greater than the maximum width of the sense traces at least at an intersection of the sense and drive traces to provide shielding for the sense traces"

200. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because they include "drive traces spatially separated from the sense traces by a dielectric, the drive traces having one or more widths including a minimum width, the minimum width of the drive traces being substantially greater than the maximum width of the sense traces at least at an intersection of the sense and drive traces to provide shielding for the sense traces." All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in the first set of traces (the sense lines) have a maximum width that is less than the minimum width of the second set of traces (the drive lines). As explained by the inventors of the '129 Patent, Apple employed this configuration in its mobile devices to help shield the sense mechanisms from the electrical interference from the LCD.

201. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of the Samsung Galaxy Tab 10.1 contains a second set of traces of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system, the second set of traces having one or more widths including a minimum width. In the Samsung Galaxy Tab 10.1, traces in this second set of conductive traces are configured to act as *drive* traces. More specifically, the second set of traces is composed of a conductive material and

oriented along a second dimension (see Figure, below) of a Cartesian grid. As shown below, each of the second set of traces has substantially the same width – a minimum width along their entire length.

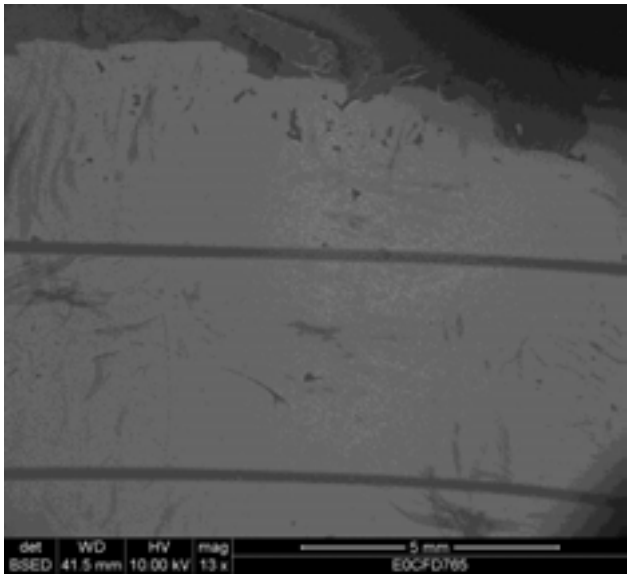


Figure. *Scanning electron micrograph of the second set of traces of the Galaxy 10.1 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. Moreover, each of the first set of traces has substantially the same width. See Exhibit C-48.*

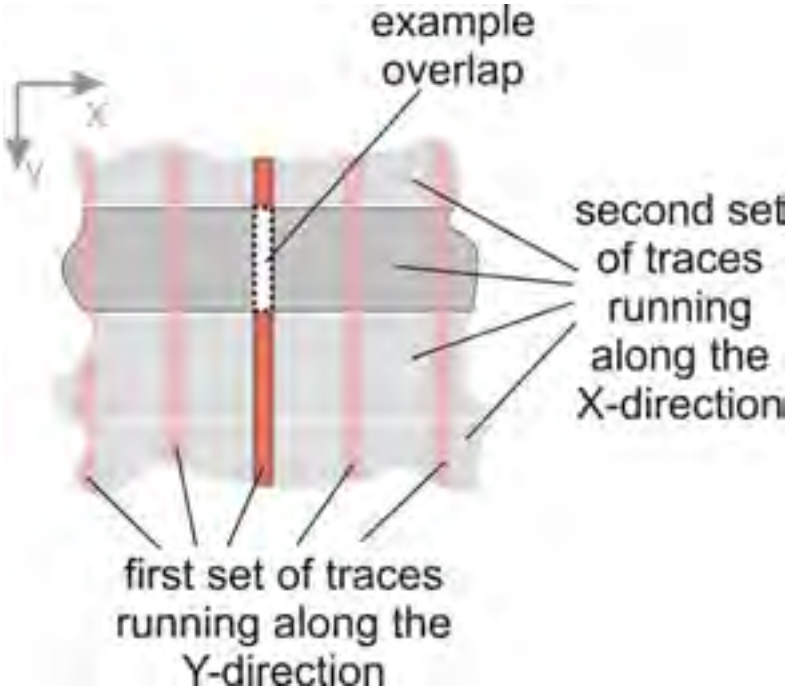


Figure. *Schematic representation of the Samsung Galaxy Tab 10.1 First and Second Set of Trace alignment. Note how the first set runs parallel to the X-axis of a Cartesian grid and the second set runs parallel to the Y-axis of a Cartesian grid.*

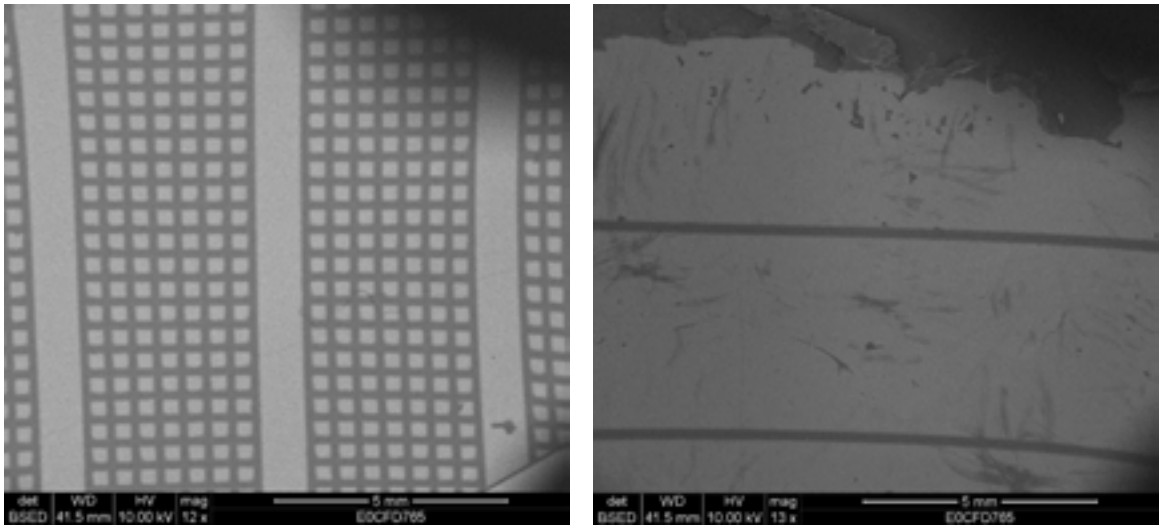


Figure. *Comparison of scanning electron micrographs of the first set of traces (left) and the second set of traces (right) of the Galaxy 10.1. See Exhibit C-15 and Exhibit C-48. The traces are on different layers.*

202. In the capacitive touch sensor panel of the Samsung Galaxy Tab 10.1, the minimum width of the second set of traces is substantially greater than the maximum width of the first set of traces at least at an intersection of the first and second sets of traces to provide shielding for the first set of traces. More specifically, the width of the traces in the first set of traces is approximately 1.0 - 1.1 mm and the width of the traces in the second set of traces is approximately 5 mm (see Figure, above).

203. Further, the second set of traces provides shielding for the first set of traces, particularly from electrical noise generated by the underlying display. A detailed explanation of why the second set of conductive traces shield the first set of conductive traces follows.

204. Figure below shows the layer stack of the Samsung Galaxy Tab 10.1 and the relative distance of the different conductive trace layers from each other and the display.

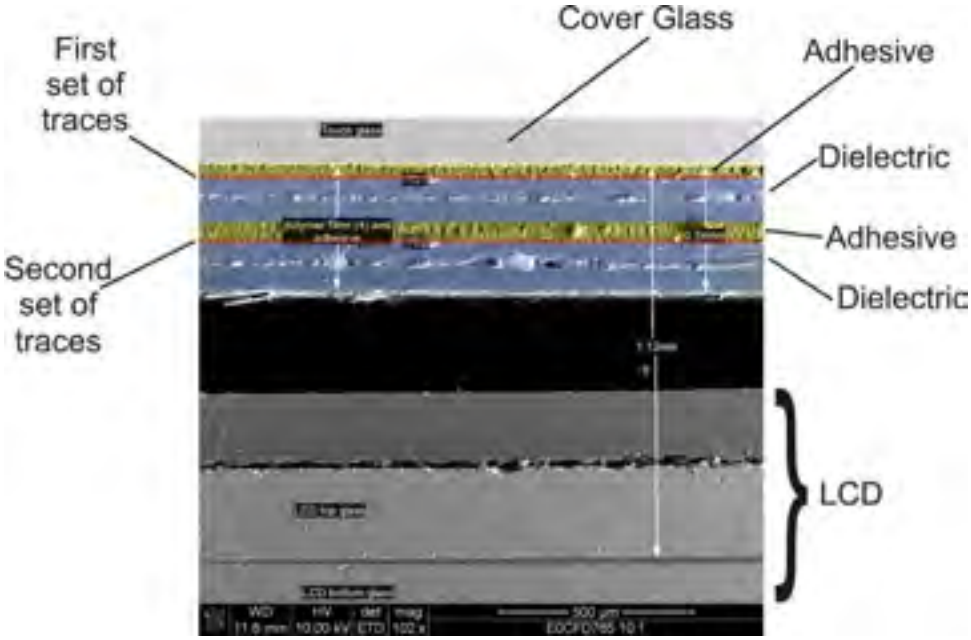


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing the various layers (and the distance between layers) detailed in the schematic illustration below. See Exhibit C-32.*

205. Wherever a trace on the first set of traces (top ITO layer) overlaps with a trace on the second set of traces (bottom ITO layer), mutual capacitance coupling occurs (Figure below).

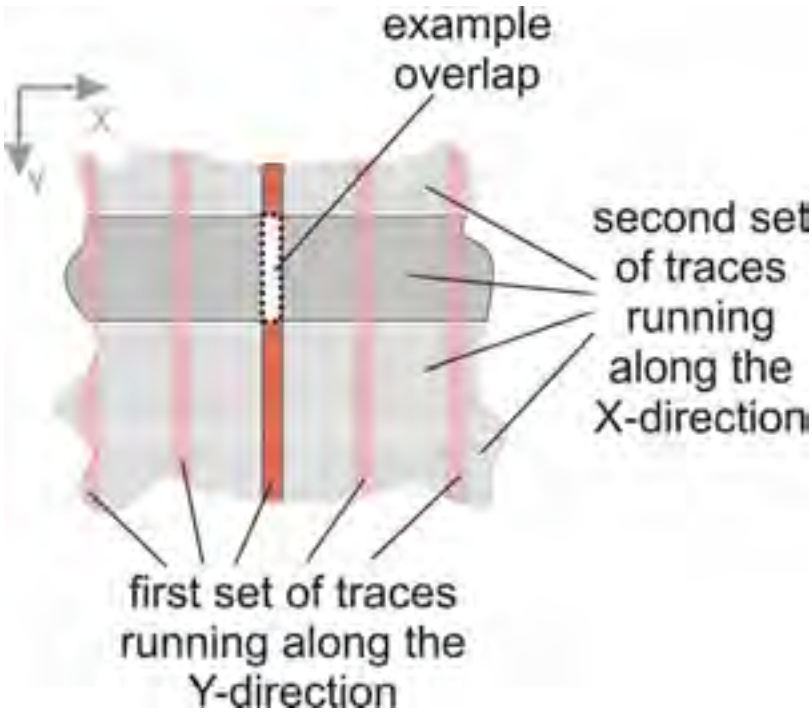


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in top and side view showing one example location where the overlap between the first and second set of traces results in capacitive coupling.*

206. Likewise, at any location where either the first set of conductive traces or the second set of conductive traces overlaps with traces existing on the LCD display, mutual capacitance coupling occurs. The figure below illustrates this schematically, where both the mutual capacitance between the first and second conductive traces is shown as well as the coupling between traces on the LCD display and the first set of conductive traces (there is also coupling between the second set of traces and the LCD, but it is less relevant since the drive traces are driven by a low impedance, high current driver –and thus less susceptible to capacitive coupling; this detail is thus omitted from the drawing).

207. Note, however, that capacitive coupling between any LCD traces and the first set of conductive traces can only occur through any ***gaps*** between traces on the second conductive layer. Any conductive regions lying on a plane between the first traces and the LCD block electric field lines between the first set of conductive traces and the display traces. This is shown schematically below. This results in the shielding effect noted above in my Shielding Calculations.

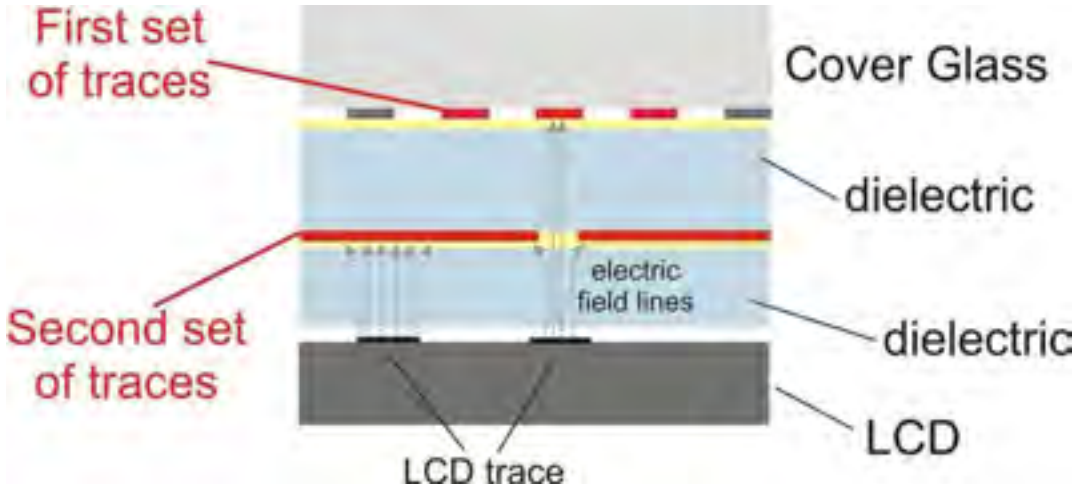


Figure. *Electric field lines can only extend between the LCD traces and the first set of traces via gaps in the second set of traces.*

208. The capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 contains a second set of traces of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system, the second set of traces having one or more widths including a minimum width. In the Samsung Galaxy Tab 10.1, traces in this second set of conductive traces are configured to act as *drive* traces. I have determined this is the case from a) an examination of Atmel touchscreen controller documents and a variety of Atmel touchscreen designs and b) personal examination of the trace routing between touchscreen controller chips and touchscreen traces leading to the ITO layer in the Samsung Galaxy Tab 10.1. In the first case, I note that both the mXT224 and mXT1386/154 chips label their 'X' pins/traces as DRIVE and their 'Y' pins/traces as SENSE. I further note that all of the touchscreen layout documents I have examined show that the 'X / DRIVE' pins are connected to traces on the ITO layer running parallel to the short side of the touchscreen (this is the layer closest to the LCD and would correspond to the "second set of traces" taught by the '129); likewise, the 'Y / DRIVE' pins are connected to traces on the ITO layer running parallel to the long side of the touchscreen (this is the layer closest to the touch glass and would correspond to the "first set of traces" taught by the '129). [redacted]

209. More specifically, the second set of traces is composed of a conductive material and oriented along a second dimension (see Figure, below) of a Cartesian grid. As shown below, each of the second set of traces has substantially the same width – a minimum width along their entire length.

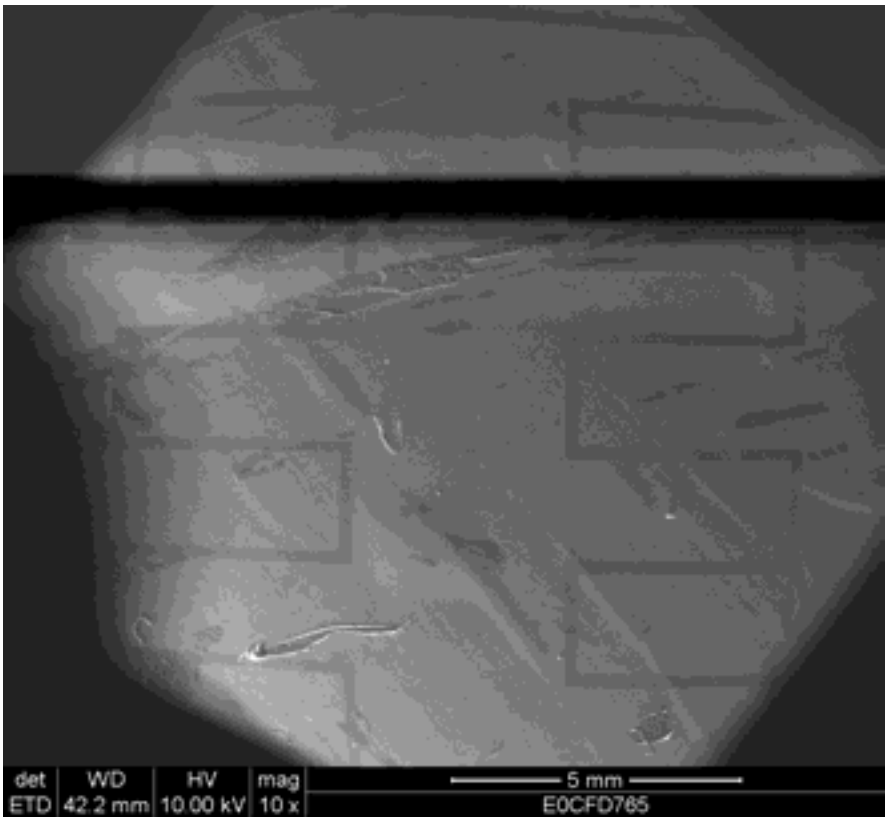


Figure. *Scanning electron micrograph of the second set of traces of the Galaxy Tab 7.0 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. Moreover, each of the first set of traces has substantially the same width. See Exhibit D-11.*

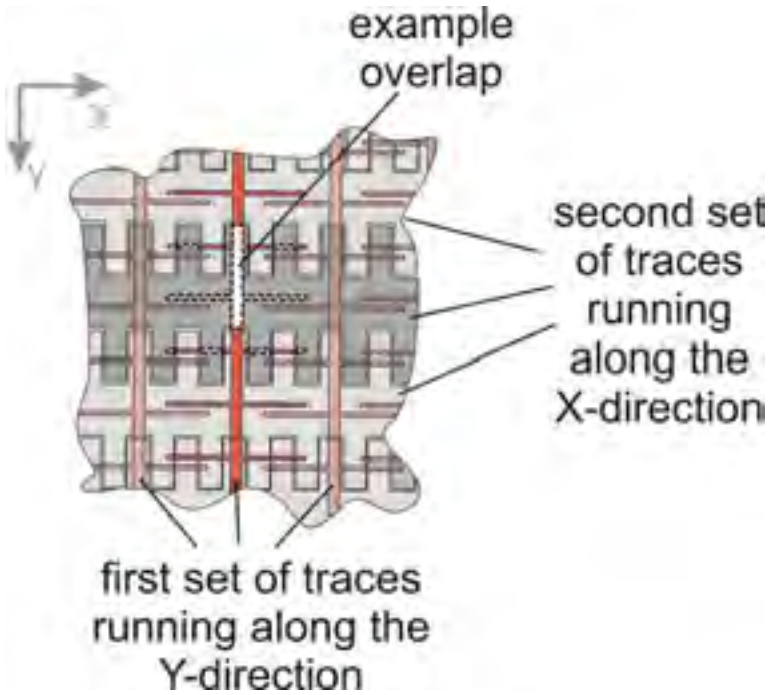


Figure. *Schematic representation of the Samsung Galaxy Tab 7.0 First and Second Set of Trace alignment. Note how the first set runs parallel to the X-axis of a Cartesian grid and the second set runs parallel to the Y-axis of a Cartesian grid.*

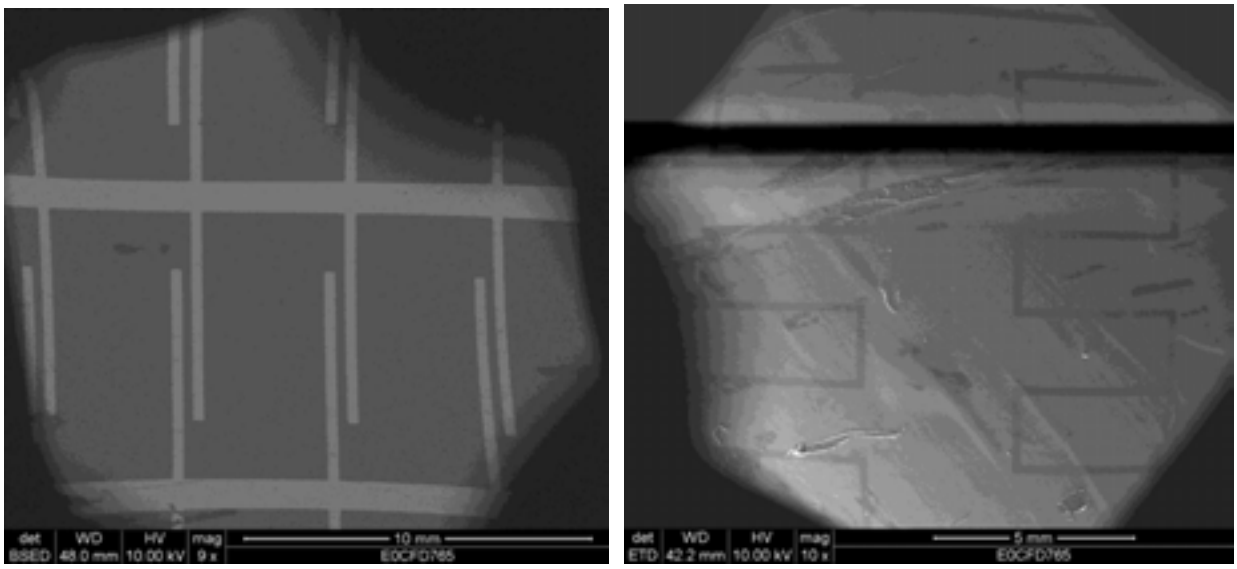


Figure. *Comparison of scanning electron micrographs of the first set of traces (left) and the second set of traces (right) of the Galaxy Tab 7.0. The traces are on different layers. See Exhibit D-15 and Exhibit D-11.*

210. In the capacitive touch sensor panel of the Samsung Galaxy Tab 7.0, the minimum width of the second set of traces is substantially greater than the maximum width of the first set of traces at least at an intersection of the first and second sets of traces to provide shielding for the first set of traces. More specifically, the width of the traces in the first set of traces is approximately 1 mm and the width of the traces in the second set of traces is approximately 4.3 mm.

211. Further, the second set of traces provides shielding for the first set of traces, particularly from electrical noise generated by the underlying display. A detailed explanation of why the second set of conductive traces shield the first set of conductive traces follows.

212. Figure below shows the layer stack of the Samsung Galaxy Tab 7.0 and the relative distance of the different conductive trace layers from each other and the display.

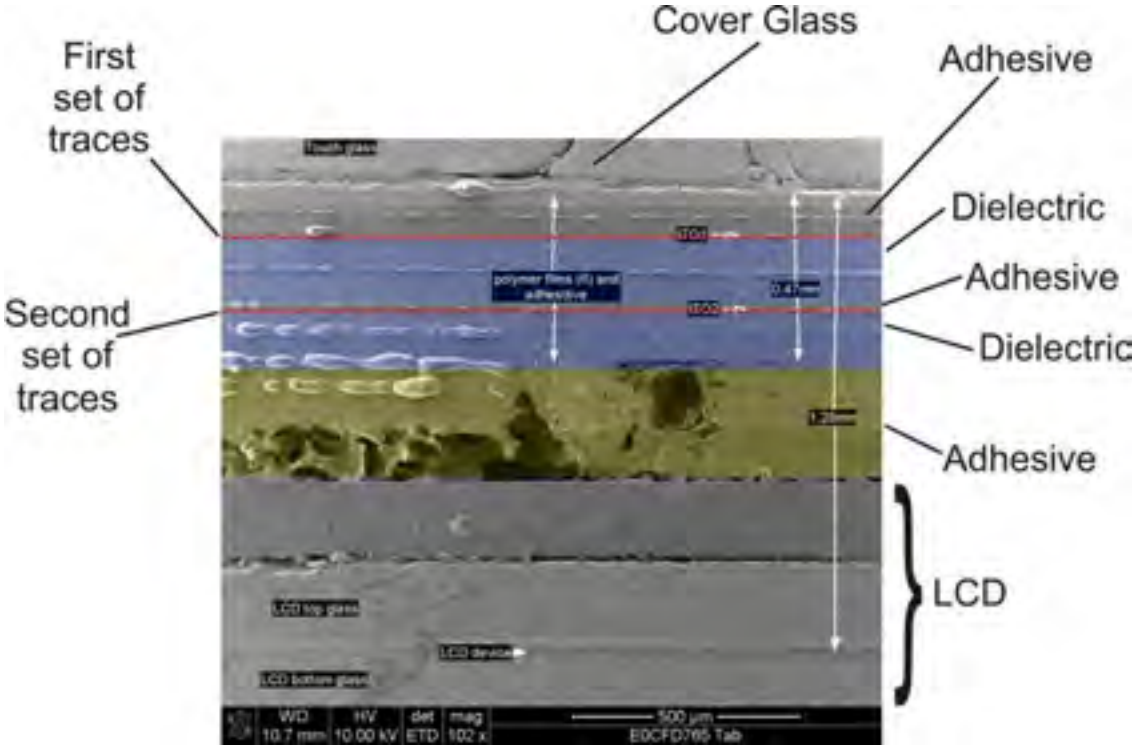


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing the various layers (and the distance between layers) detailed in the schematic illustration below. See Exhibit D-27.*

213. Wherever a trace on the first set of traces (top ITO layer) overlaps with a trace on the second set of traces (bottom ITO layer), mutual capacitance coupling occurs (Figure below).

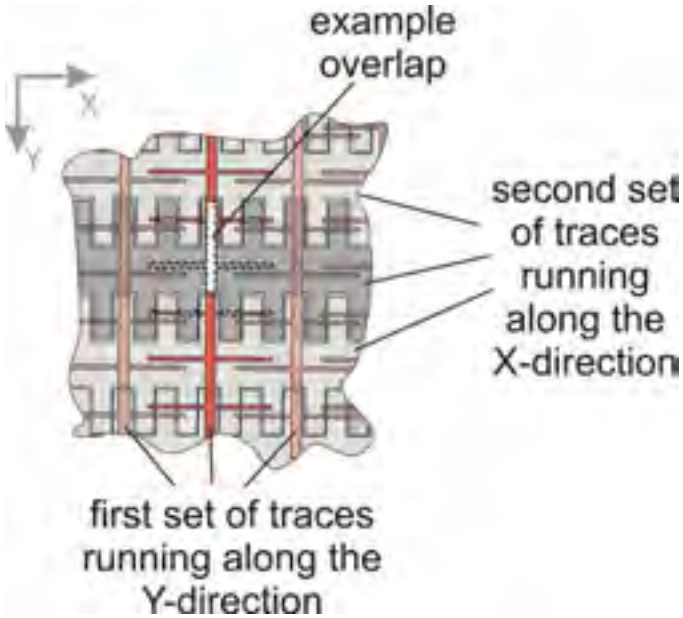


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touch panel in top view showing one example location where the overlap between the first and second set of traces results in capacitive coupling.*

214. Likewise, at any location where either the first set of conductive traces or the second set of conductive traces overlaps with traces existing on the LCD display, mutual capacitance coupling occurs. The figure below illustrates this schematically, where both the mutual capacitance between the first and second conductive traces is shown as well as the coupling between traces on the LCD display and the first set of conductive traces (there is also coupling between the second set of traces and the LCD, but it is less relevant since the drive traces are driven by a low impedance, high current driver –and thus less susceptible to capacitive coupling; this detail is thus omitted from the drawing).

215. Note, however, that capacitive coupling between any LCD traces and the first set of conductive traces can only occur through any ***gaps*** between traces on the second conductive layer. Any conductive regions lying on a plane between the first traces and the LCD block electric field lines between the first set of conductive traces and the display traces. This is shown schematically below.

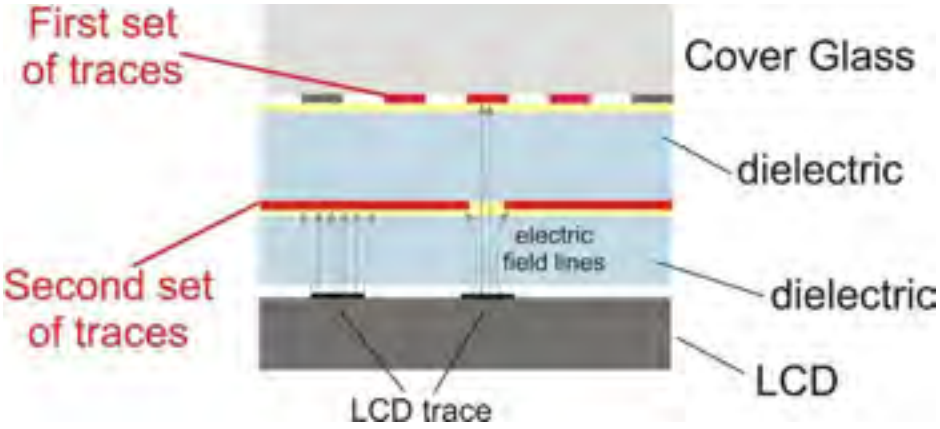


Figure. *Electric field lines can only extend between the LCD traces and the first set of traces via gaps in the second set of traces.*

216. This results in the shielding effect noted above in my Shielding Calculations.

18. Claim 10: "wherein sensors are formed at locations at which the sense traces intersect with the drive traces while separated by the dielectric."

217. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because in each "sensors are formed at locations at which the sense traces intersect with the drive traces while separated by the dielectric." All of the Apple products I examined use a mutual capacitance sensing method in which sensors are formed at the intersections of the first set of traces and the second set of traces, which are separated by a dielectric.

218. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. In the capacitive touch sensor panel of the Samsung Galaxy 10.1, sensors are formed at locations where the first set of traces intersects with the second set of traces while separated by the dielectric. Specifically, the Samsung Galaxy Tab 10.1 uses a touchscreen based on mutual capacitance, in which capacitive touch sensors are formed at each intersection of the two sets of traces (see Figure below). As also shown below, the first and second sets of traces are separated by a plastic dielectric.

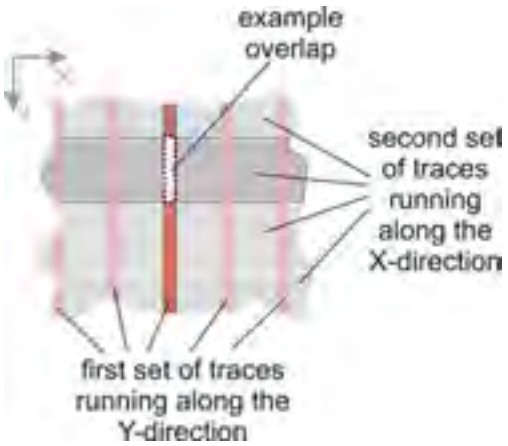


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in top and side view showing one example location where the overlap between the first and second set of traces results in a mutual capacitive touch sensor.*

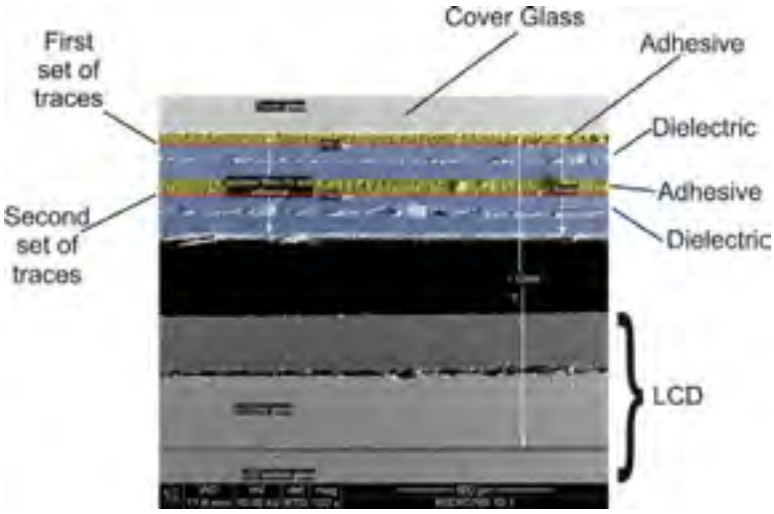


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit C-32.*

219. In the capacitive touch sensor panel of the Samsung Galaxy Tab 7.0, sensors are formed at locations where the first set of traces intersects with the second set of traces while separated by the dielectric. Specifically, the Samsung Galaxy Tab 7.0 uses a touchscreen based on mutual capacitance, in which capacitive touch sensors are formed at each intersection of the two sets of traces (see Figure below). As also shown below, the first and second sets of traces are separated by a plastic dielectric.

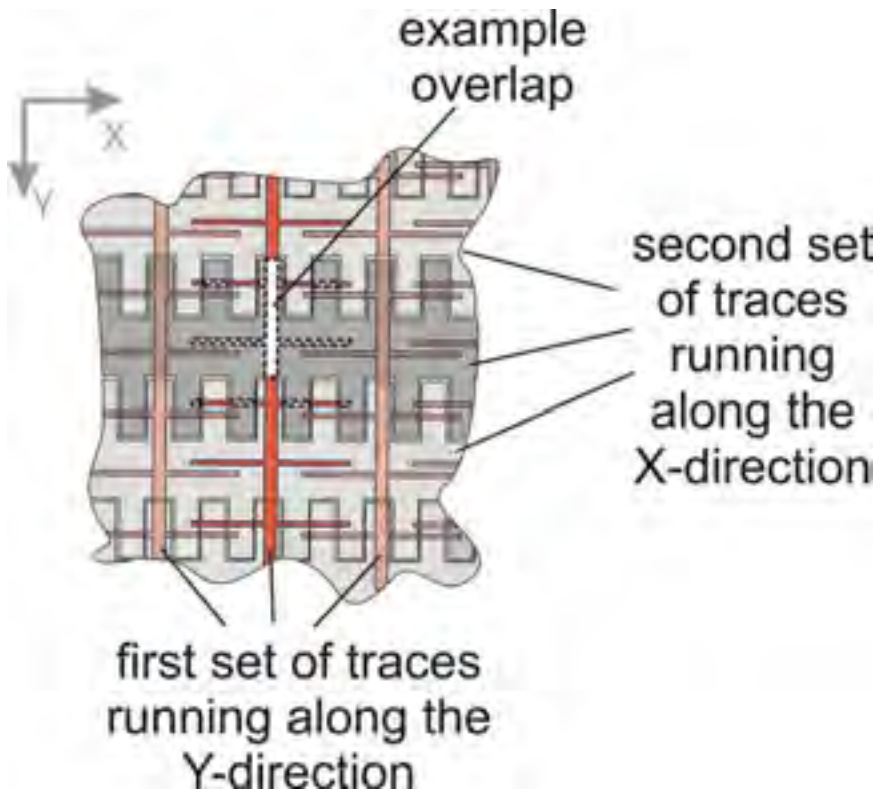


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in top and side view showing one example location where the overlap between the first set and second set of traces results in a mutual capacitive touch sensor.*

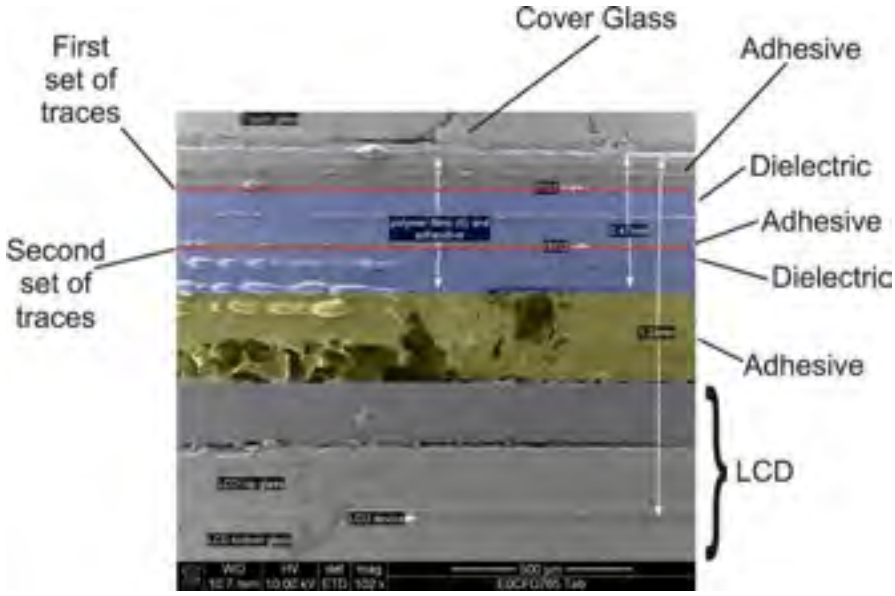


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit D-27.*

220. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 10 of the '129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

19. Claim 12: "The capacitive touch sensor panel of claim 10, wherein the drive traces are widened to substantially electrically isolate the sense traces from a liquid crystal display (LCD)."

221. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because in the Apple "the drive traces are widened to substantially electrically isolate the sense traces from a liquid crystal display (LCD)." As noted above, the second set of traces (drive lines) are widened for the purpose of substantially electrically isolating the first set of traces (sense lines) from the LCD. That is why they are widened and I have determined that the electrical isolation they provide is substantial.

222. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The second set of traces in the capacitive touch sensor panel of the Samsung Galaxy Tab 10.1 are widened to substantially electrically isolate the first set of traces from a liquid crystal

display (LCD). More specifically, the Samsung Galaxy Tab 10.1 contains a 10.1-inch WXGA TFT (PLS) LCD touchscreen. (*See, e.g.*, APLNDC-Y0000060376.) As set forth above under the detailed infringement analysis for Claim 1, the second set of traces are located between the LCD and the first set of traces, and are widened to a width of approximately 5 mm to electrically isolate the first set of traces from the device's LCD.

223. The second set of traces in the capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 are widened to substantially electrically isolate the first set of traces from a liquid crystal display (LCD). More specifically, the Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. (*See, e.g.*, APLNDC-Y0000063879.) As set forth above under the detailed infringement analysis for Claim 1, the second set of traces are located between the LCD and the first set of traces, and are widened so as to produce a minimal gap of 0.33 mm to electrically isolate the first set of traces from the device's LCD.

224. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 12 of the '129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

20. Claim 14: "The capacitive touch sensor panel of claim 10, further comprising a computing system that incorporates the sensor panel."

225. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted]

[redacted]. I conclude that those Apple products meet this limitation because the Apple "capacitive touch sensor panel" in each further includes "a computing system that incorporates the sensor panel." Each of the Apple iPhone and iPad products I examined included a microprocessor and other computing components, such as memory, which is a computing system. This is self-evident from the functionality of the devices, which compute inputs, present content, and run millions of possible computer program applications, from Angry Birds to iTunes.

226. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 and Galaxy 10.1 include a computing system that incorporates the sensor panel. More specifically, they each contains a microprocessor, such as the dual-core Tegra 2 processor, and other computing components, such as memory, and is therefore a computing system. (*See, e.g.*, http://www.samsung.com/us/mobile/galaxy-tab/SCH-I905UWAVZW-features, accessed 8 March 2012: "The central processing unit is the world's first mobile super chip – the NVIDIA® Tegra™ 2 dual core 1 GHz processor, to run all your functions and apps effortlessly.") (APLNDC-Y0000234098—4104 at APLNDC-Y0000234099.)

227. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 14 of the '129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

21. Claim 16: "The capacitive touch sensor panel of claim 14, further comprising a digital audio player that incorporates the computing system."

228. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to

their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because the "capacitive touch sensor panel" in each further includes "a digital audio player that incorporates the computing system." Each of the Apple iPhone and iPad products I examined included a digital audio player that incorporates a microprocessor and other computing components, such as memory, which is a computing system. This is self-evident from the functionality of the devices, which compute inputs, downloads music and other digital audio content, and play a nearly infinite library of music through Apple's proprietary iTunes audio management and Apple's iTunes Store.

229. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of these devices further comprises a digital audio player that incorporates the computing system. More specifically, the Galaxy Tab 10.1 and Galaxy Tab 7.0 play music and other audio files (using Windows Media Player, for example) and therefore comprise a digital audio player. (*See, e.g.*, APLNDC-Y0000060377; APLNDC-Y0000060436-446; APLNDC-Y0000065323; APLNDC-Y0000065355-56; APLNDC-Y0000065957-59; APLNDC-Y0000063927-932.)

230. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 16 of the '129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

22. Claim 24 Preamble: "A capacitive touch sensor panel, comprising"

231. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because they include "A capacitive touch sensor panel." Indeed, all of the Apple products I examined included a touch sensor that is based upon measurement or detection of capacitive coupling.

232. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Samsung Galaxy Tab 10.1 has a capacitive touch sensor panel. Specifically, the Galaxy Tab 10.1 contains a 10.1-inch WXGA TFT (PLS) LCD touchscreen. (*See, e.g.*, Tab 10.1 User Manual at APLNDC-Y0000060376). The Samsung Galaxy Tab 7.0 has a capacitive touch sensor panel. The Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. This is described and shown in the Samsung Galaxy Tab User 7.0 Manual. APLNDC-Y0000063879.

23. Claim 24: "sense traces formed on a first layer and arranged along a first dimension of a two-dimensional coordinate system; and"

233. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation

because they include “sense traces formed on a first layer and arranged along a first dimension of a two-dimensional coordinate system.” All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in sense traces are formed on the first set.

234. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of the Samsung Galaxy Tab 10.1 contains a first set of traces (the sense lines) of conductive material arranged along a first dimension of a two-dimensional coordinate system. Specifically, the first set of traces is composed of a conductive material and oriented along one dimension of a Cartesian grid.

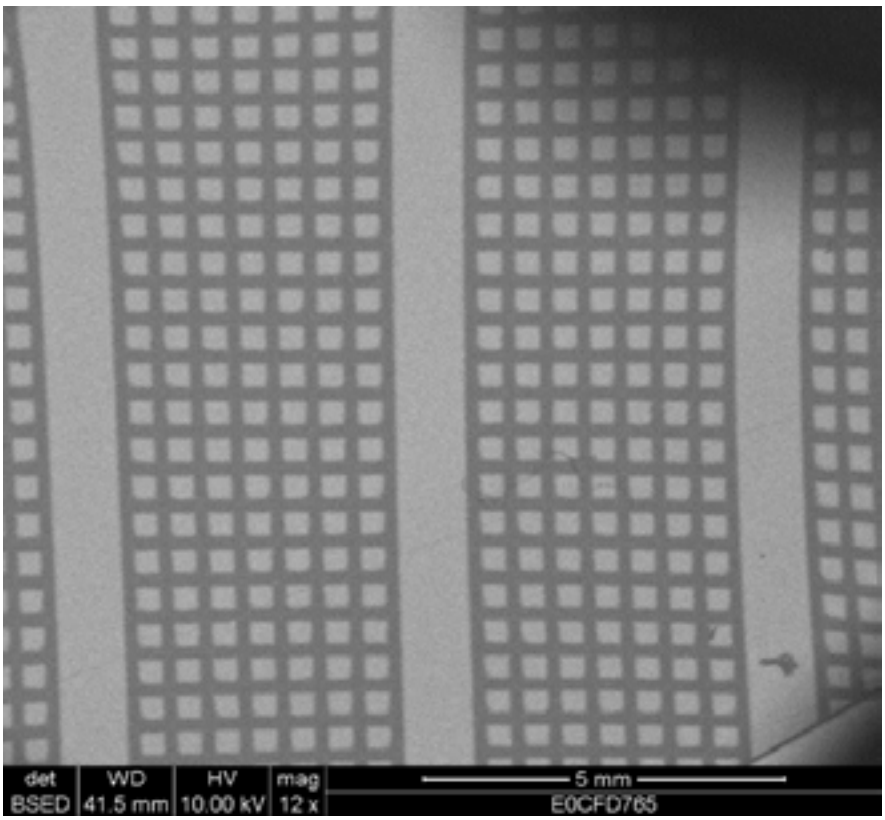


Figure. *Scanning electron micrograph of the first set of traces (running vertical) in a Galaxy Tab 10.1 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. See Exhibit C-15.*

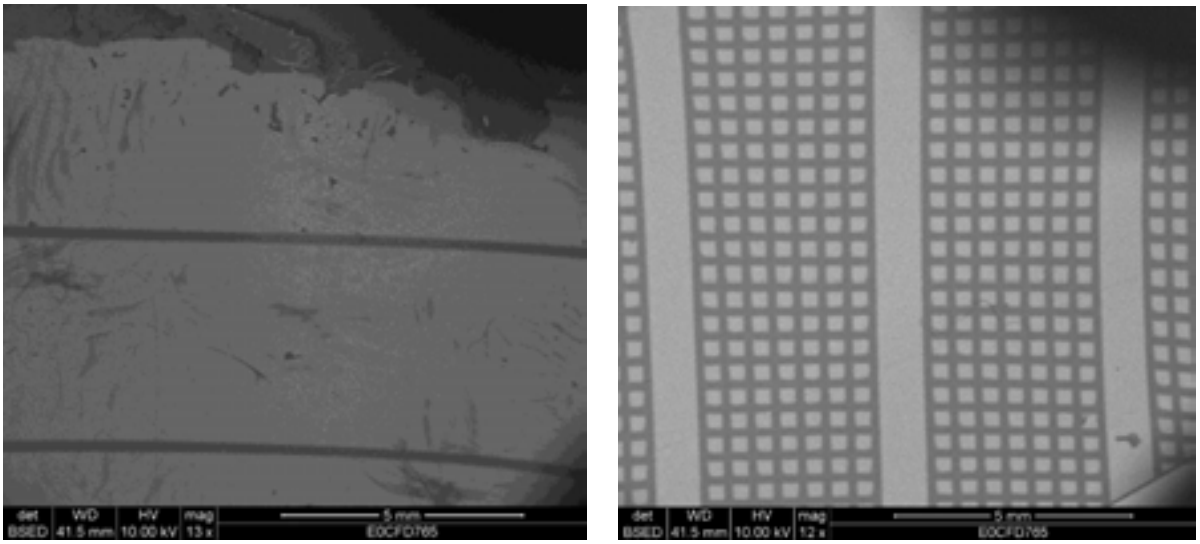


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the first or* <u>*sense*</u> *(right) and second or* <u>*drive*</u> *set of traces (left) of the Galaxy Tab 10.1 aligned along the X-Y plane as they are within the touchscreen. See Exhibit C-48; Exhibit C-15.*

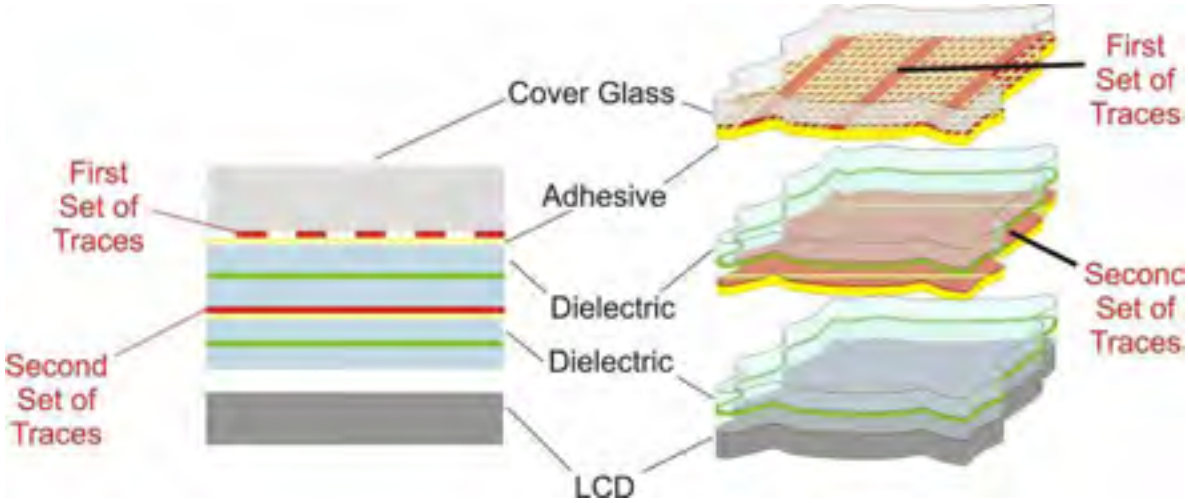


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touchpanel in cross-section (left) and isometric assembly view (right).*

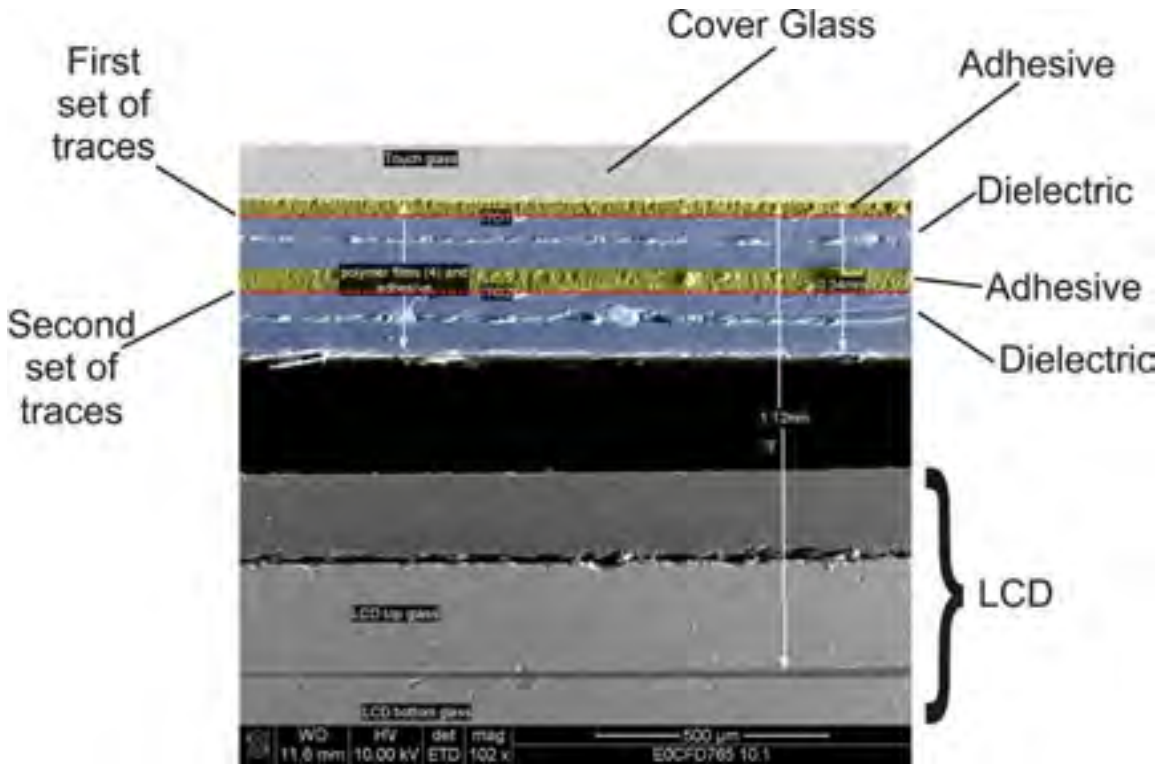


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing the various layers detailed in the schematic illustration, above. (Exhibit C-32.)*

235. The capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 contains a first set of traces (the sense lines) of conductive material arranged along a first dimension of a two-dimensional coordinate system,. Specifically, the first set of traces is composed of a conductive material and oriented along one dimension of a Cartesian grid..

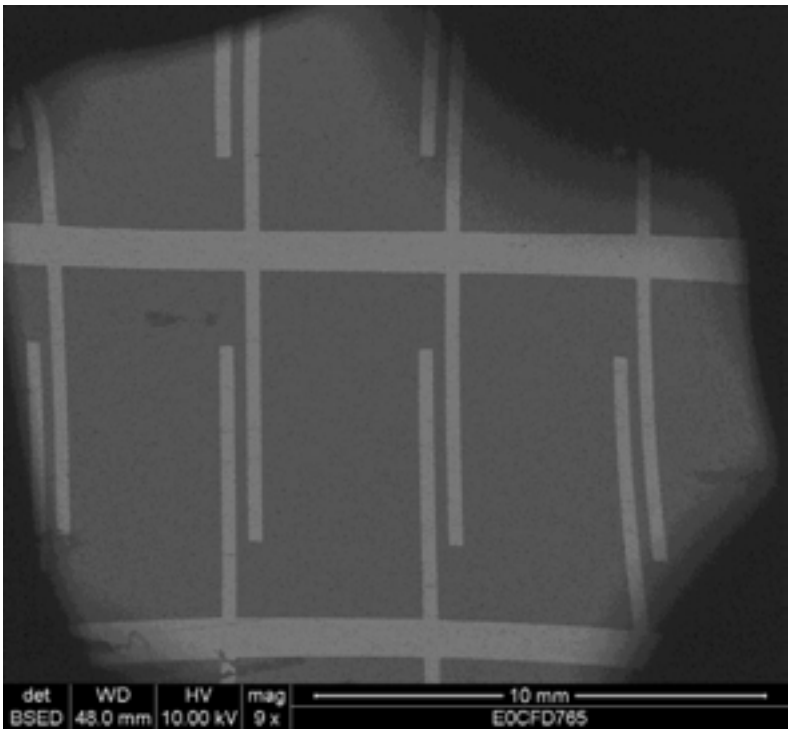


Figure. *Scanning electron micrograph of the first set of traces (running horizontally) in a Galaxy Tab 7.0 showing how the electrodes are oriented parallel to one axis on a Cartesian grid. Moreover, each of the first set of traces has substantially the same width. (See Exhibit D-15.)*

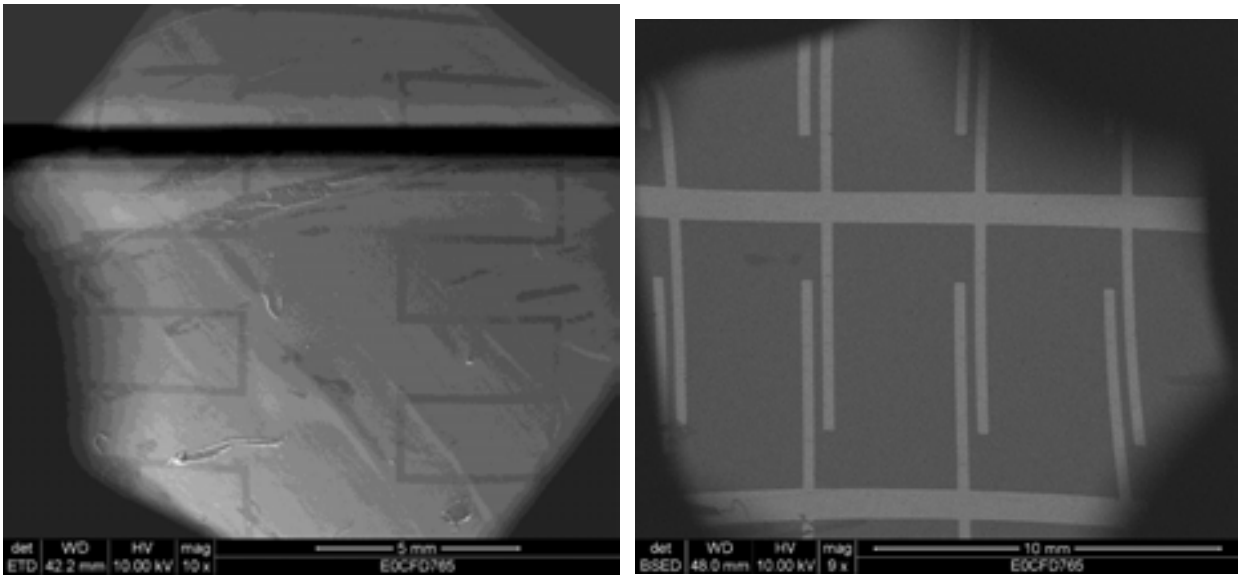


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the first or <u>sense</u> (right) and second or <u>drive</u> set of traces (left) of the Galaxy Tab 7.0 aligned along the X-Y plane as they are within the touchscreen. (See Exhibit D-11; Exhibit D-12.)*

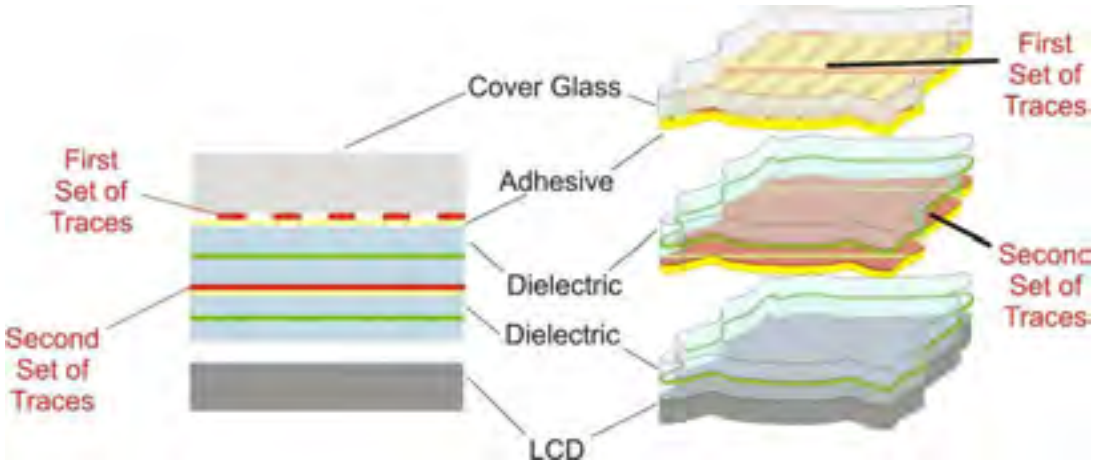


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in cross-section (left) and isometric assembly view (right).*

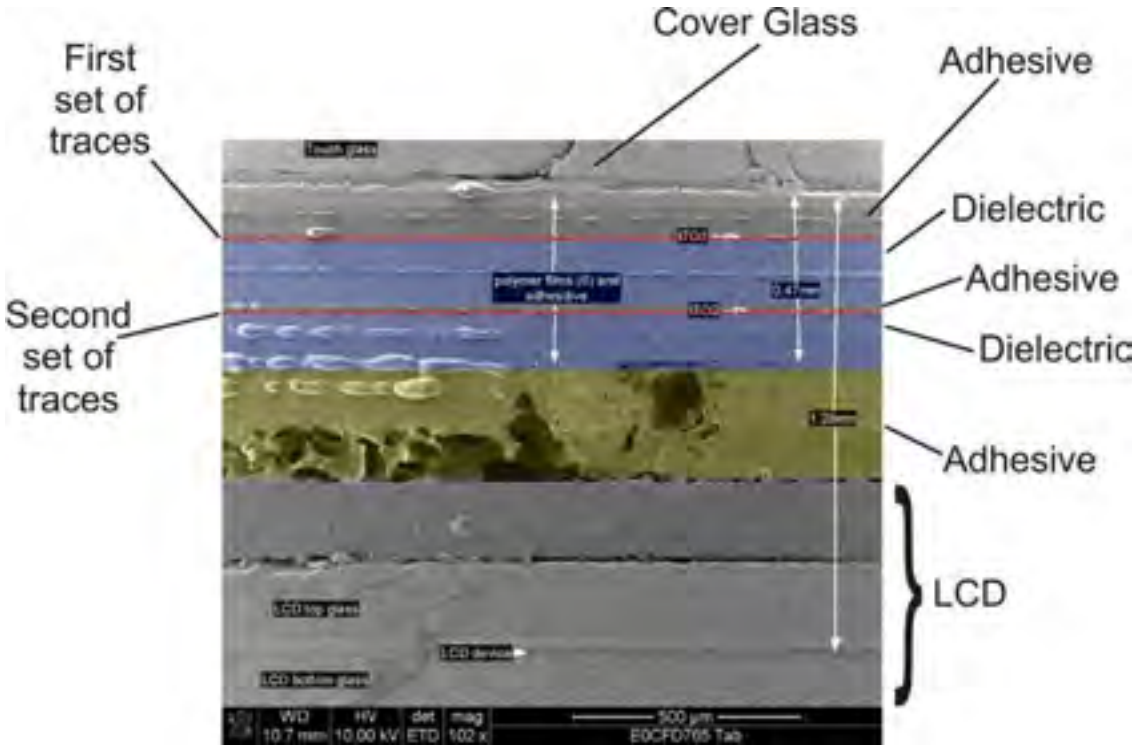


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing the various layers detailed in the schematic illustration, above. (See Exhibit D-27.)*

24. Claim 24: "drive traces formed on a second layer spatially separated from the first layer by a dielectric, the drive traces arranged along a second dimension of the two-dimensional coordinate system"

236. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because they include "drive traces formed on a second layer spatially separated from the first layer by a dielectric, the drive traces arranged along a second dimension of the two-dimensional coordinate system" All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in the second set of traces (the drive lines) are spatially separated from the first set of traces by a dielectric.

237. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The capacitive touch sensor panel of the Samsung Galaxy Tab 10.1 contains a second set of traces (the drive lines) of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system.

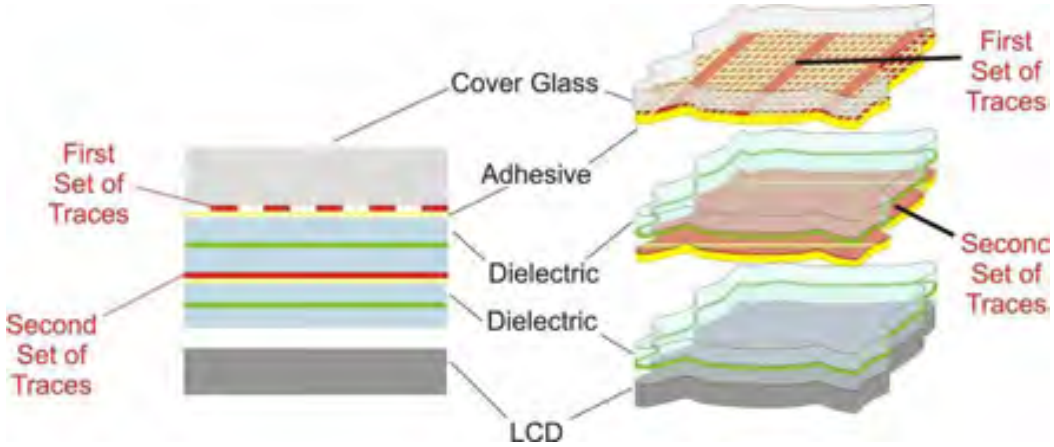


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touchpanel in cross-section (left) and isometric assembly view (right).*

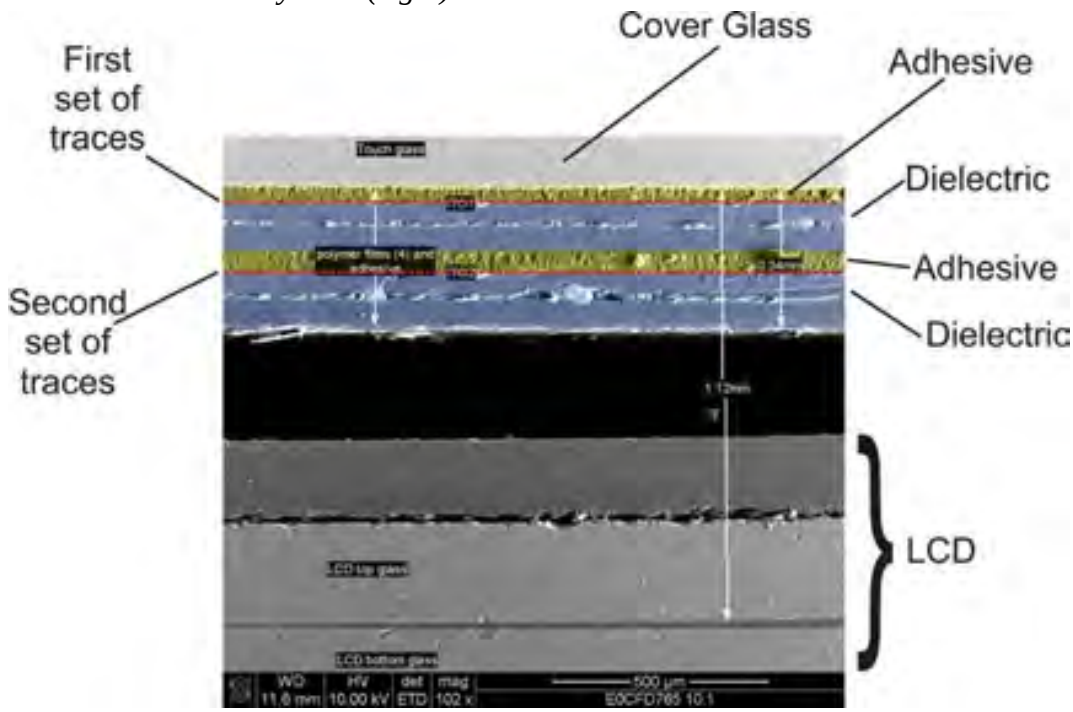


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing the various layers detailed in the schematic illustration, above.*

238. More specifically, the second set of traces is composed of a conductive material and oriented along a second dimension (see Figure, below) of a Cartesian grid.

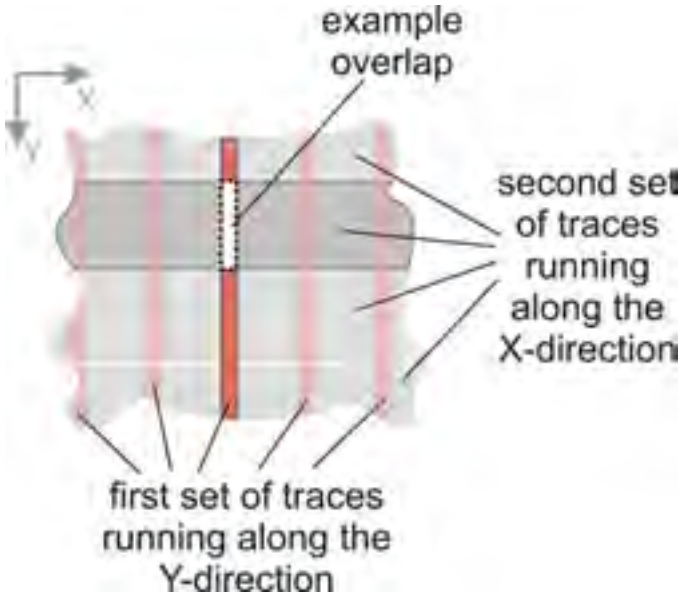


Figure. *Schematic representation of the Samsung Galaxy Tab 10.1 First and Second Set of Trace alignment. Note how the first set runs parallel to the Y-axis of a Cartesian grid and the second set runs parallel to the X-axis of a Cartesian grid. The dummy features between the first set of traces have been omitted for clarity.*

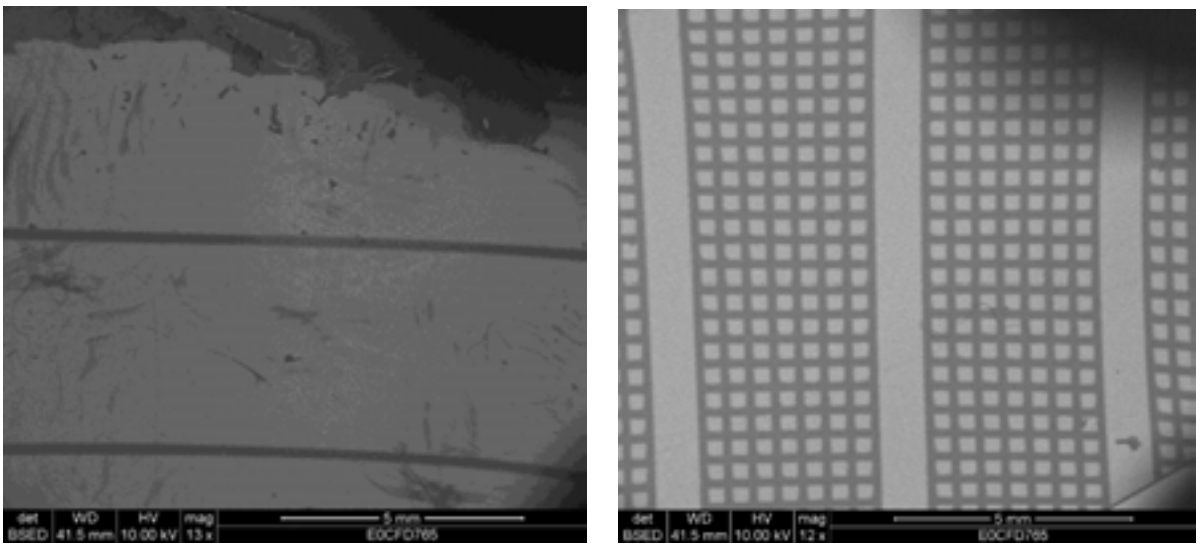


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the first or* <u>*sense*</u> *(right) and second or* <u>*drive*</u> *set of traces (left) of the Galaxy Tab 10.1 aligned along the X-Y plane as they are within the touchscreen. See Exhibit C-48; Exhibit C-15. The traces are on different layers.*

239. The capacitive touch sensor panel of the Samsung Galaxy Tab 7.0 contains a second set of traces (the drive lines) of the conductive material spatially separated from the first set of traces by a dielectric and arranged along a second dimension of the two-dimensional coordinate system.

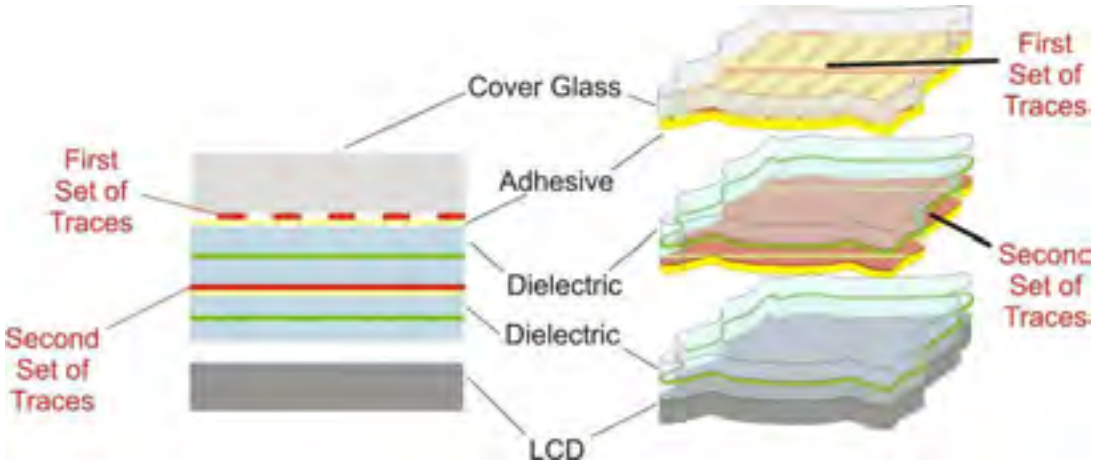


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in cross-section (left) and isometric assembly view (right).*

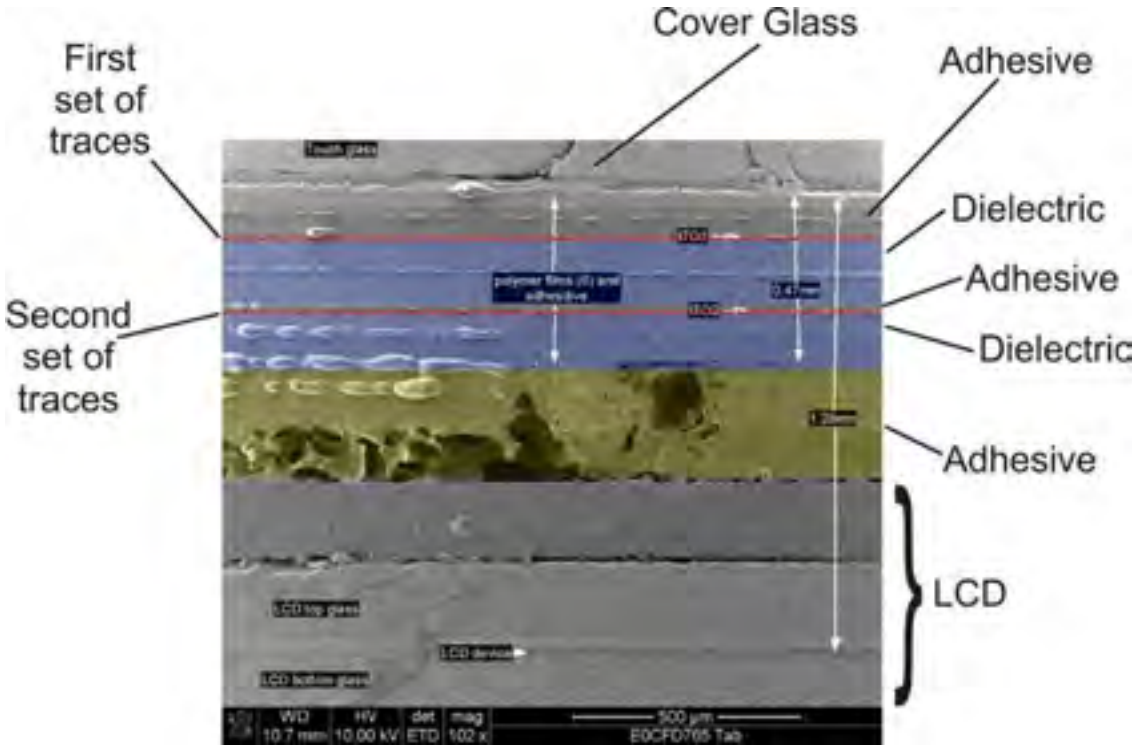


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing the various layers detailed in the schematic illustration, above. See Exhibit D-27.*

240. More specifically, the second set of traces (the drive lines) is composed of a conductive material and oriented along a second dimension (see Figure, below) of a Cartesian grid.

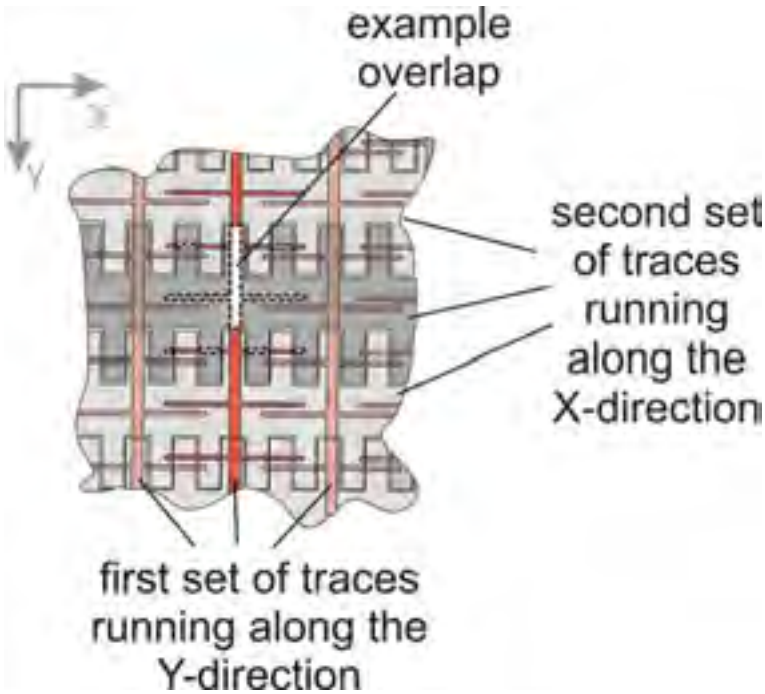


Figure. *Schematic representation of the Samsung Galaxy Tab 7.0 First and Second Set of Trace alignment. Note how the first set runs parallel to the X-axis of a Cartesian grid and the second set runs parallel to the Y-axis of a Cartesian grid.*

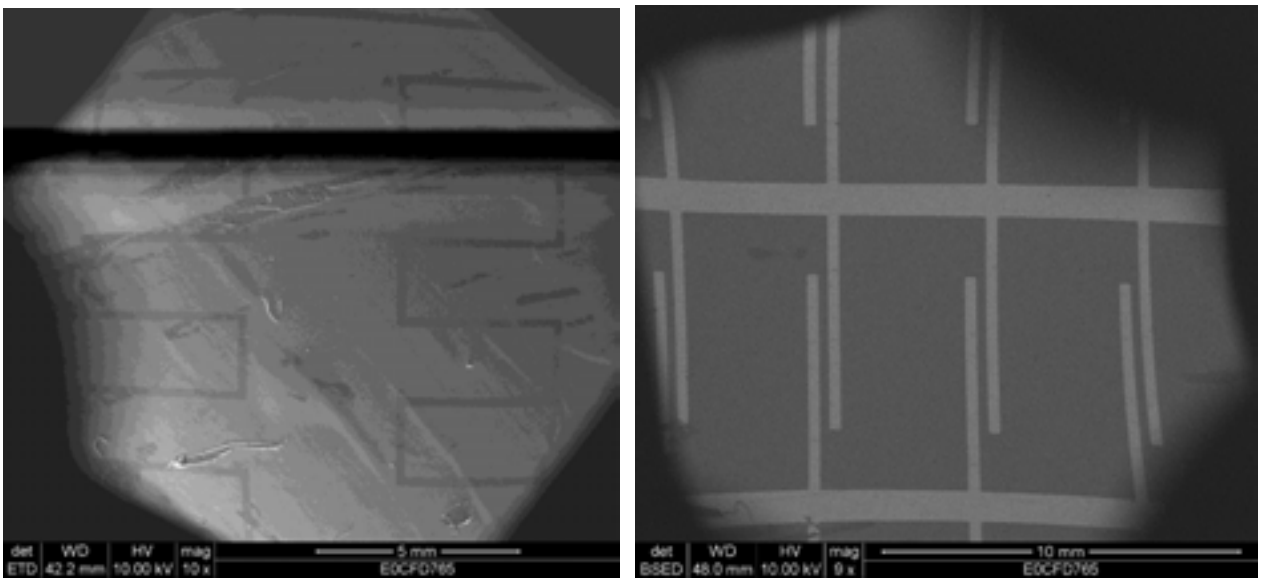


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the first or* <u>*sense*</u> *(right) and second or* <u>*drive*</u> *set of traces (left) of the Galaxy Tab 7.0 aligned along the X-Y plane*

as they are within the touchscreen. See Exhibit D-15; Exhibit D-11. The traces are on different layers.

25. Claim 24: "wherein the drive traces are widened as compared to the sense traces to substantially cover the second layer except for a gap between adjacent drive traces so as to substantially electrically isolate the sense traces from a liquid crystal display (LCD)"

241. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because in each "wherein the drive traces are widened as compared to the sense traces to substantially cover the second layer except for a gap between adjacent drive traces so as to substantially electrically isolate the sense traces from a liquid crystal display (LCD)." All of the Apple products I examined include a liquid crystal display underneath and directly adjacent to the touch sensor that emits electrical signals that are "noise" to the touch sensor. All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in the first set of traces (the sense lines) have a maximum width that is less than the minimum width of the second set of traces (the drive lines). As noted above, the second set of traces (drive lines) are widened for the purpose of substantially electrically isolating the first set of traces (sense lines) from the LCD. That is why they are widened and I have determined that the electrical isolation they provide is substantial. This results in the shielding effect noted above in my Shielding Calculations.

242. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The touch sensor panel of the Samsung Galaxy Tab 10.1 contains drive traces that are widened as compared to the sense traces to substantially cover the second layer except for a

gap between adjacent drive traces so as to substantially electrically isolate the sense traces from a liquid crystal display (LCD). More specifically, the Samsung Galaxy Tab 10.1 contains a 10.1-inch WXGA TFT (PLS) LCD touchscreen. (*See, e.g.*, APLNDC-Y0000060376.). The drive traces are located between the LCD and the sense traces (see figure below), and are widened to approximately 5 mm to substantially cover the second layer except for the etch gaps between adjacent drive traces to electrically isolate the sense traces from the device's LCD.

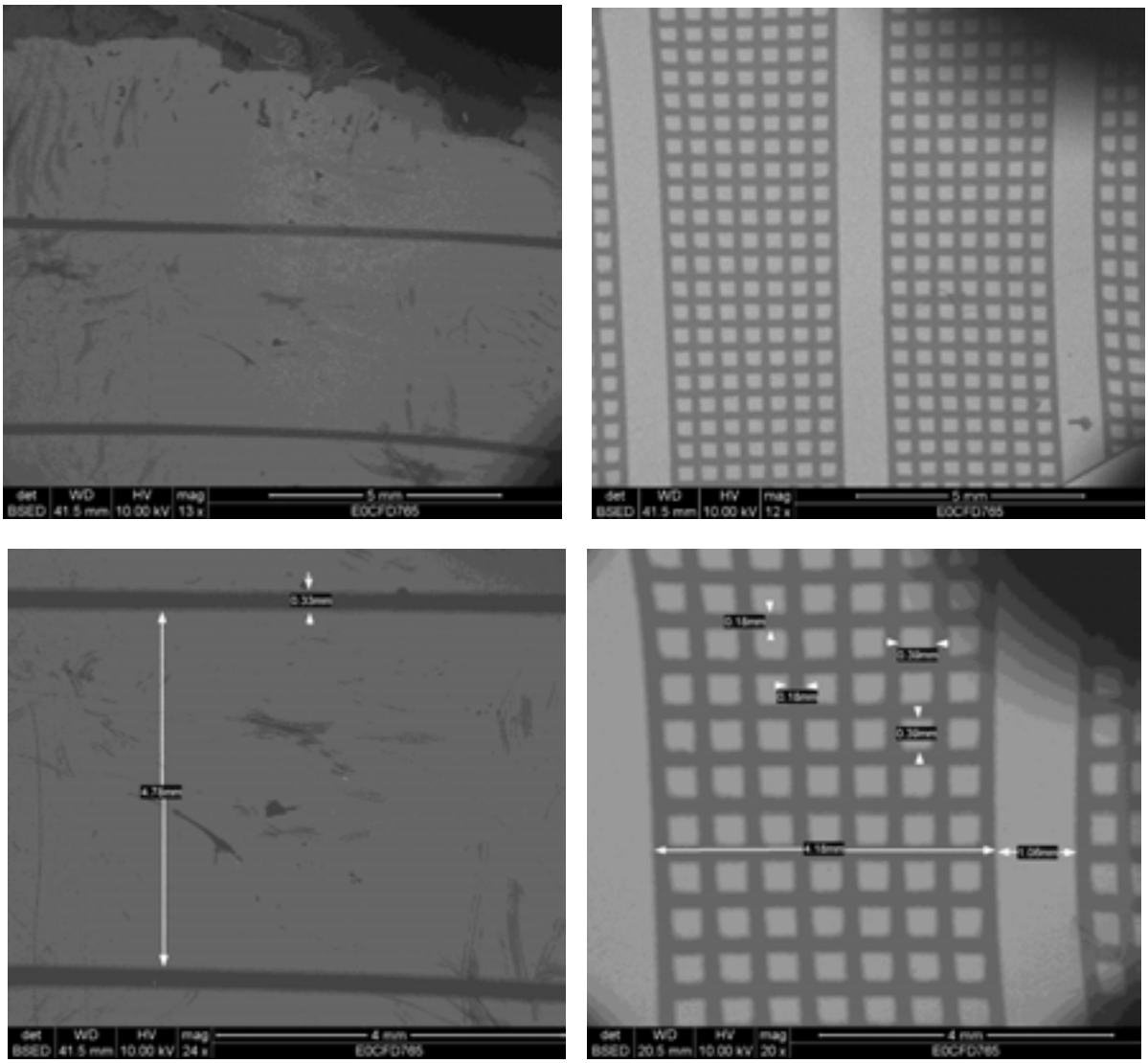


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the first or* <u>*sense*</u> *(top right) and second or* <u>*drive*</u> *set of traces (top left) of the Galaxy Tab 10.1 aligned along the X-Y plane as they are within the touchscreen. See Exhibit C-48; Exhibit C-50; Exhibit C-15; and*

Exhibit C-17. Note how the drive traces (4.78 mm, bottom left) have been widened approximately 5 mm to substantially cover the second layer except for the etch gaps (0.33 mm, bottom left) between adjacent drive traces to electrically isolate the sense traces (top and bottom right) from the device's LCD.

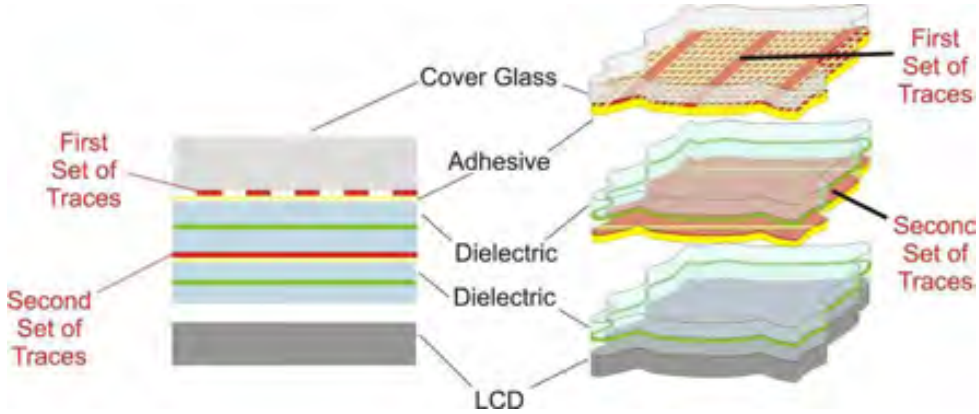


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touchpanel in cross-section (left) and isometric assembly view (right).*

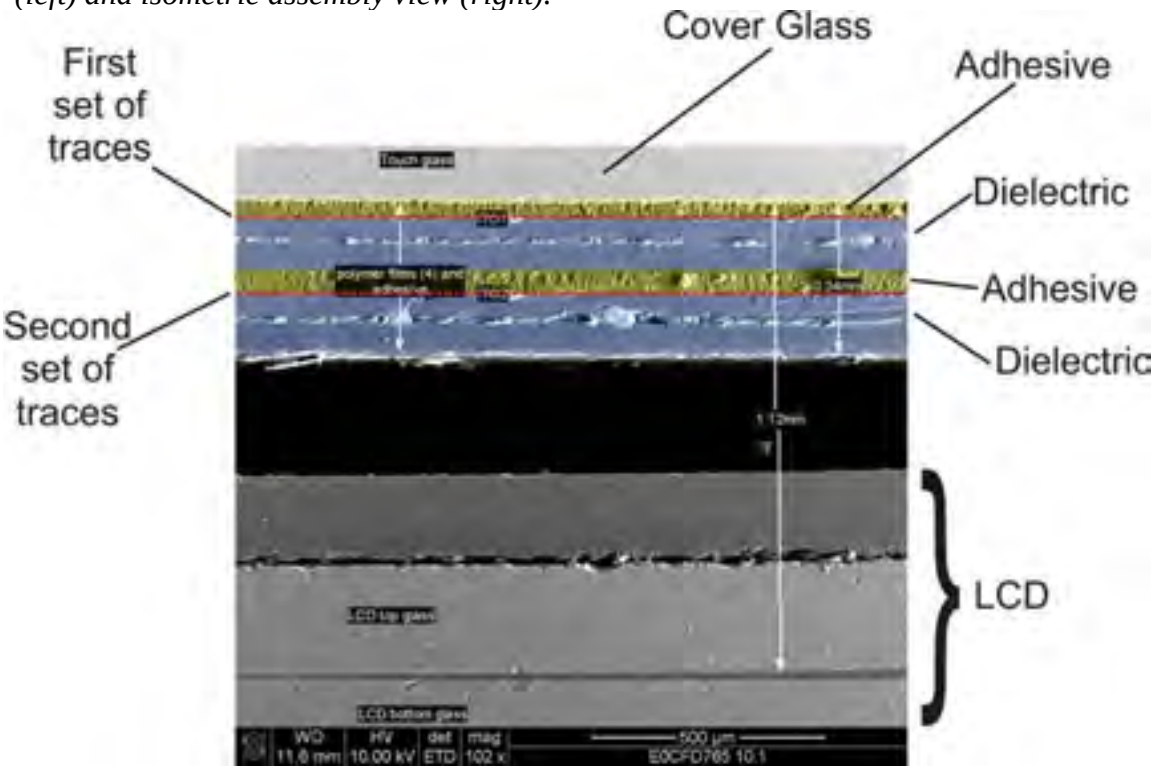
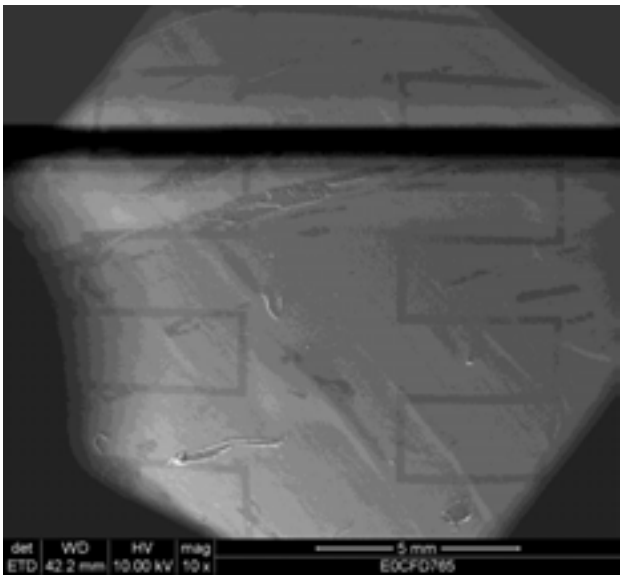
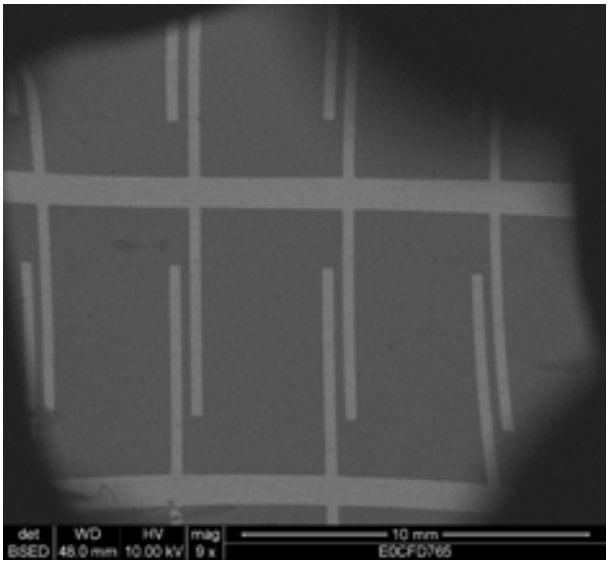


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing the various layers detailed in the schematic illustration, above. (Exhibit C-32.)*

243. The touch sensor panel of the Samsung Galaxy Tab 7.0 contains drive traces that are widened as compared to the sense traces to substantially cover the second layer except for a gap between adjacent drive traces so as to substantially electrically isolate the sense traces from a liquid crystal display (LCD). The Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. Tab User 7.0 Manual at APLNDC-Y0000063879. The drive traces are located between the LCD and the sense traces (see figure below), and are widened to approximately 5 mm to substantially cover the second layer except for the etch gaps between adjacent drive traces to electrically isolate the sense traces from the device's LCD.





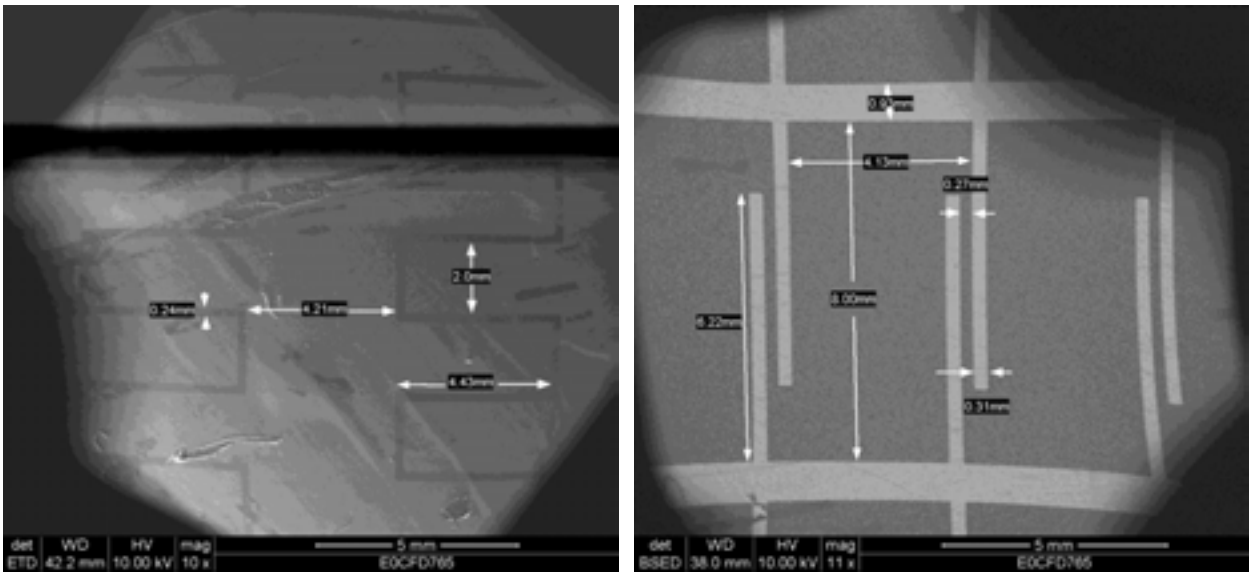


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the first or* <u>*sense*</u> *(top right) and second or* <u>*drive*</u> *set of traces (top left)of the Galaxy Tab 7.0 aligned along the X-Y plane as they are within the touchscreen. See Exhibit D-11; Exhibit D-12; Exhibit D-15; and Exhibit D-17. Note how the drive traces (4.21 mm, bottom left) have been widened approximately to substantially cover the second trace layer except for the etch gaps (0.24 mm, bottom left) between adjacent drive traces to electrically isolate the sense traces (top and bottom right) from the device's LCD.*

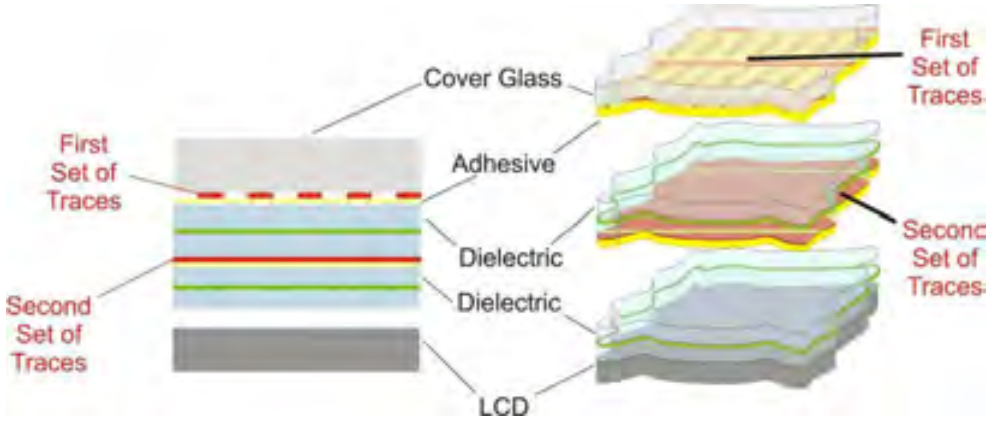


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in cross-section (left) and isometric assembly view (right).*

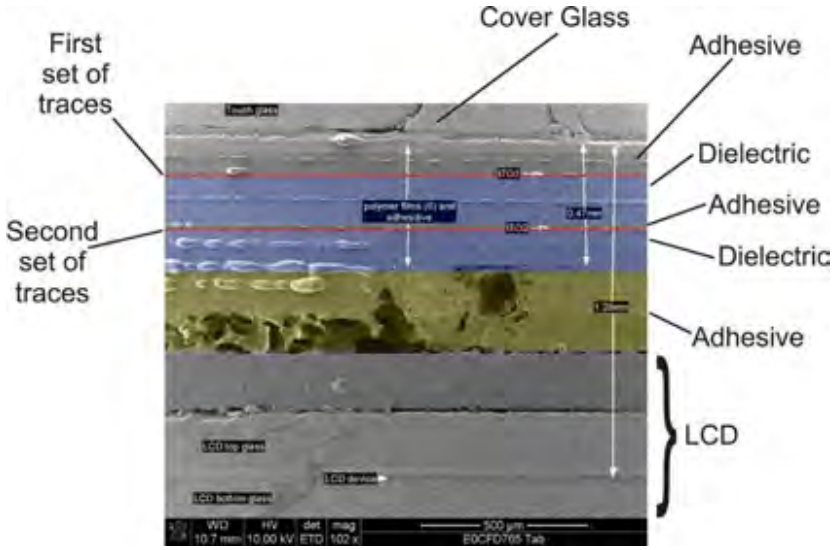


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing the various layers detailed in the schematic illustration, above. See Exhibit D-27.*

26. Claim 24: "wherein sensors are formed at locations at which the sense traces intersect with the drive traces while separated by the dielectric"

244. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because in each "sensors are formed at locations at which the sense traces intersect with the drive traces while separated by the dielectric." All of the Apple products I examined use a mutual capacitance sensing method in which sensors are formed at the intersections of the first set of traces and the second set of traces, which are separated by a dielectric.

245. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. In the capacitive touch sensor panel of the Samsung Galaxy 10.1, sensors are formed

at locations where the first set of traces intersects with the second set of traces while separated by the dielectric. Specifically, the Samsung Galaxy Tab 10.1 uses a touchscreen based on mutual capacitance, in which capacitive touch sensors are formed at each intersection of the two sets of traces (see Figure below). As also shown below, the first and second sets of traces are separated by a plastic dielectric.

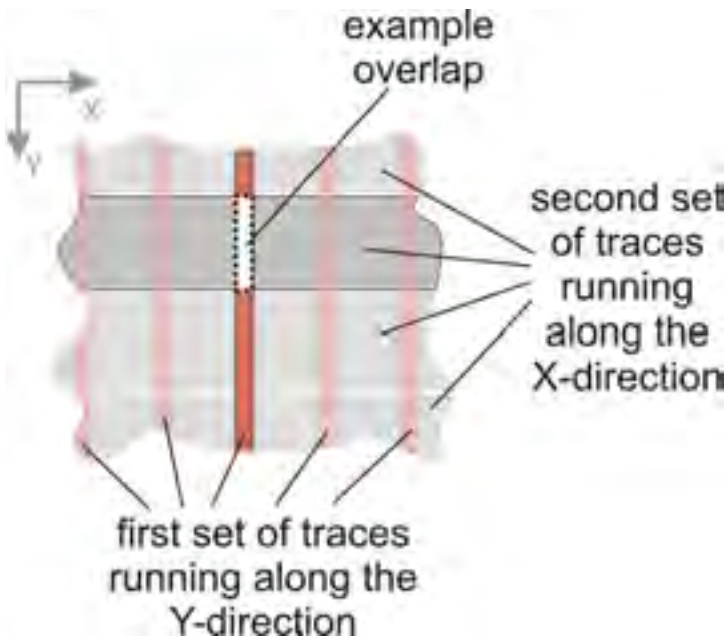


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touch panel in top and side view showing one example location where the overlap between the first and second set of traces results in a mutual capacitive touch sensor.*

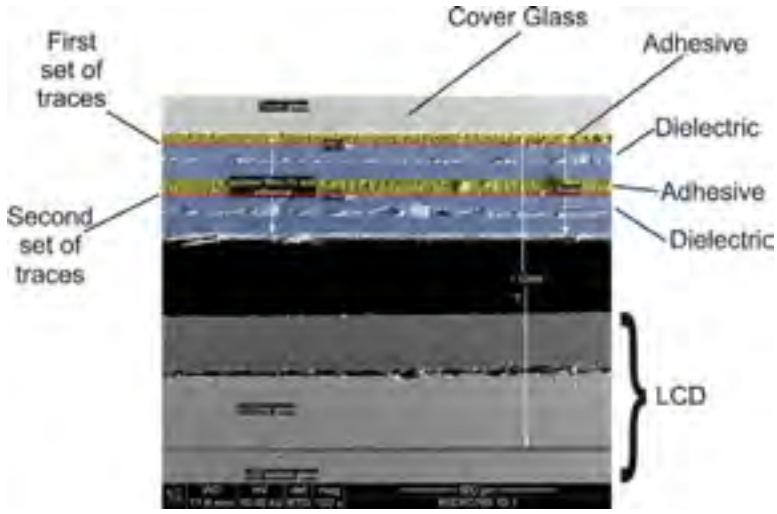


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit C-32.*

246. In the capacitive touch sensor panel of the Samsung Galaxy Tab 7.0, sensors are formed at locations where the first set of traces intersects with the second set of traces while separated by the dielectric. Specifically, the Samsung Galaxy Tab 7.0 uses a touchscreen based on mutual capacitance, in which capacitive touch sensors are formed at each intersection of the two sets of traces (see Figure below). As also shown below, the first and second sets of traces are separated by a plastic dielectric.

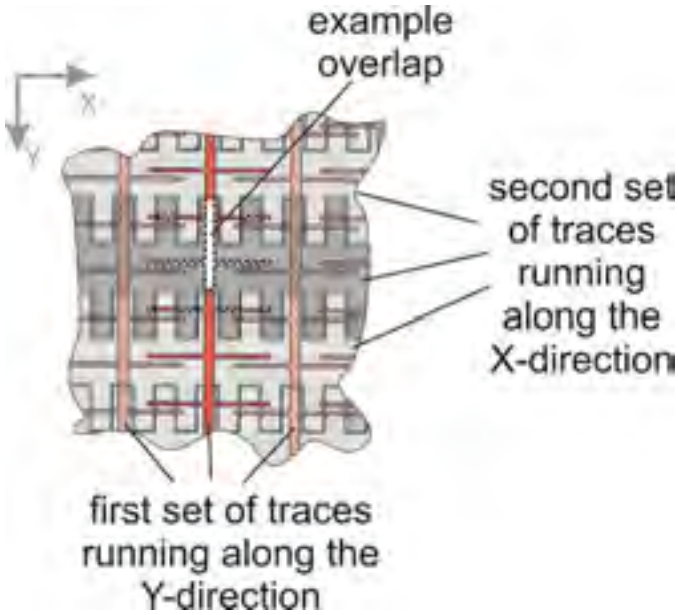


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in top and side view showing one example location where the overlap between the first set and second set of traces results in a mutual capacitive touch sensor.*

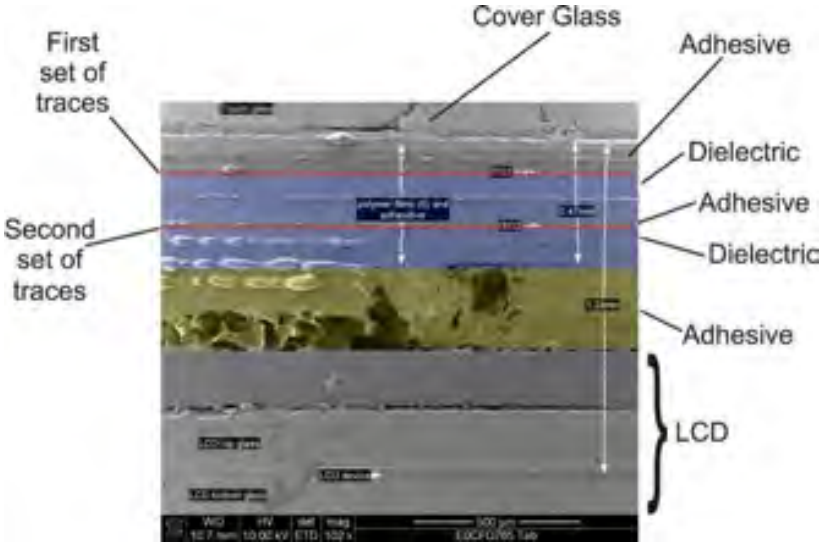


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit D-27.*

27. Claim 24: "wherein each of the drive traces is of a substantially constant width"

247. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because in those Apple products "each of the drive traces is of a substantially constant width." In all of the Apple products that I examined, the drive lines are deposited in ITO with substantially constant widths.

248. In the touch sensor panel of the Samsung Galaxy Tab 10.1, the drive traces are each of a substantially constant width, as illustrated below.

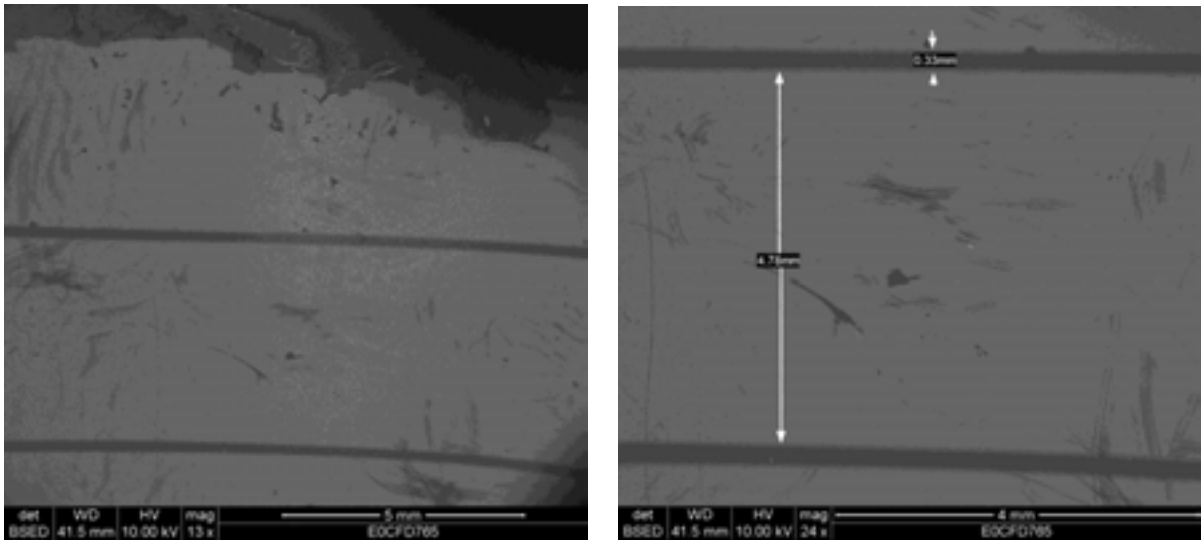


Figure. *Scanning Electron Micrographs (SEM) of the second or* <u>*drive*</u> *set of traces of the Galaxy Tab 10.1. Note how the drive traces have a substantially constant width. See Exhibit C-48 and Exhibit C-50.*

249. In the touch sensor panel of the Samsung Galaxy Tab 7.0, the drive traces are each of a substantially constant width, as illustrated below.

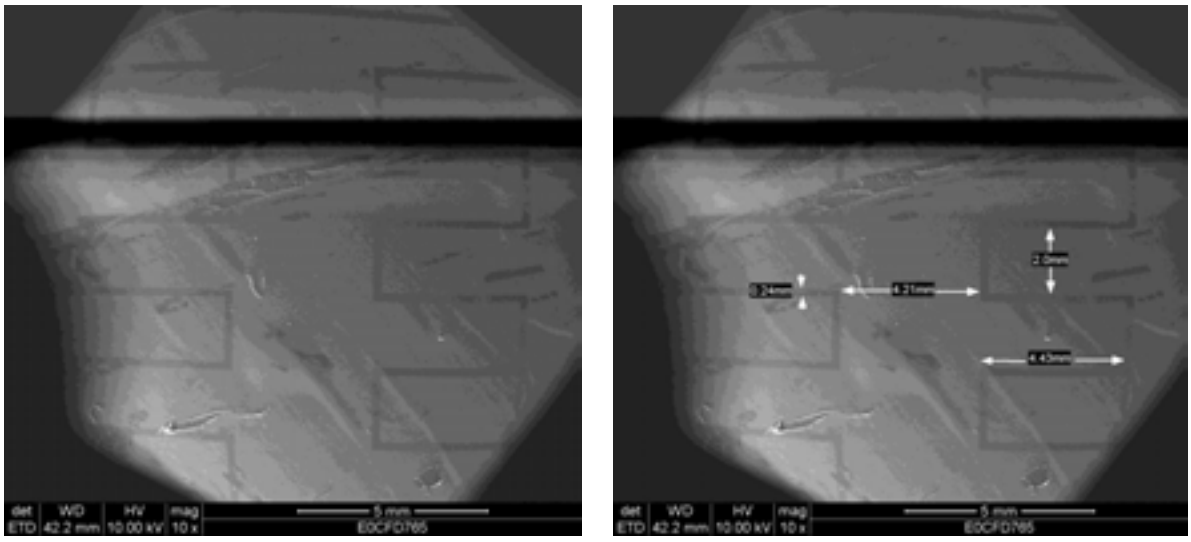


Figure. *Scanning Electron Micrographs (SEM) of the second or* <u>*drive*</u> *set of traces of the Galaxy Tab 7.0. Note how the drive traces have a substantially constant width. See Exhibit D-11 and Exhibit D-12.*

250. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 24 of the ’129 Patent, I conclude that these products literally

infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

28. Claim 26 Preamble: "A touch sensitive computing system"

251. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because each of those products includes a "touch sensitive computing system." All of the Apple products I examined included a touch sensor that is based upon measurement or detection of capacitive coupling. Each of the Apple iPhone and iPad products I examined included a microprocessor and other computing components, such as memory, which is a computing system that responds to user input through the touch sensor. This is self-evident from the functionality of the devices, which compute inputs, present content, and run millions of possible interactive computer program applications, from Angry Birds to iTunes.

252. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 comprise a touch sensitive computing system that includes a touch processor, a display, and a touch sensor panel adjacent to the display and coupled to the touch processor. More specifically, the Galaxy Tab 10.1 contains a 10.1-inch WXGA TFT (PLS) LCD touchscreen. (*See, e.g.*, APLNDC-Y0000060376.) The Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. This is described and shown in Samsung Galaxy Tab User 7.0 Manual at APLNDC-Y0000063879. Further, the Galaxy Tab 7.0 and Galaxy Tab 10.1 contains a microprocessor, such as the dual-core Tegra 2 processor, and

other computing components, such as memory, and is therefore a computing system. (*See, e.g.*, http://www.samsung.com/us/mobile/galaxy-tab/SCH-I905MSAVZW-features?) ("The central processing unit is the world's first mobile super chip – the NVIDIA® Tegra™ 2 dual core 1GHz processor, to run all your functions and apps effortlessly.") (APLNDC-Y0000234091—097 at APLNDC-Y0000234092.)

29. Claim 26: "a touch processor"

253. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because each of those products includes a "touch processor." All of the Apple products I examined included a touch sensor that interacts with a touch processor, sometimes called a controller, including for example, the Zephyr I made by Broadcom, that receives and processes information from the touch panel.

254. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 comprise a touch sensitive computing system that includes a touch processor. As noted repeatedly above, the Galaxy Tab 7.0 uses an mxt224 touchscreen controller. The Galaxy Tab 10.1 uses an Atmel mxt1386 and mxt154 touchscreen controller set. In each of these Samsung products, a touch sensor interacts with the Atmel touch processor that that receives and processes information from the touch screen panel.

30. Claim 26: "a display"

255. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to

their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because each includes "a display." As noted above and as is obvious upon inspection, each of these Apple products includes a liquid crystal display used to show the user graphical content.

256. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The Galaxy Tab 10.1 contains a 10.1-inch WXGA TFT (PLS) LCD touchscreen. (*See, e.g.*, APLNDC-Y0000060376.) The Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. This is described and shown in Samsung Galaxy Tab User 7.0 Manual at APLNDC-Y0000063879.

31. Claim 26: "a touch sensor panel adjacent to the display and coupled to the touch processor, the touch sensor panel including sense traces formed on a first layer, and drive traces formed on a second layer spatially separated from the first layer, the drive traces widened as compared to the sense traces to substantially cover the second layer except for a gap between adjacent drive traces so as to substantially electrically isolate the sense traces from a liquid crystal display (LCD)"

257. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because in each the "capacitive touch sensor panel" includes "a touch sensor panel adjacent to the display and coupled to the touch processor, the touch sensor panel including sense traces formed on a first layer, and drive traces formed on a second layer spatially separated from the first layer,

the drive traces widened as compared to the sense traces to substantially cover the second layer except for a gap between adjacent drive traces so as to substantially electrically isolate the sense traces from a liquid crystal display (LCD)." All of the Apple products I examined include a liquid crystal display underneath and directly adjacent to the touch sensor that emits electrical signals that are "noise" to the touch sensor. All of the Apple iPhone and iPad devices I examined include two sets of conductive lines in a two-dimensional coordinate system where in the first set of traces (the sense lines) have a maximum width that is less than the minimum width of the second set of traces (the drive lines). As noted above, the second set of traces (drive lines) are widened for the purpose of substantially electrically isolating the first set of traces (sense lines) from the LCD. That is why they are widened and I have determined that the electrical isolation they provide is substantial. This results in the shielding effect noted above in my Shielding Calculations.

258. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. The touch sensor panel of the Samsung Galaxy Tab 10.1 contains drive traces that are widened as compared to the sense traces to substantially cover the second layer except for a gap between adjacent drive traces so as to substantially electrically isolate the sense traces from a liquid crystal display (LCD). More specifically, the Samsung Galaxy Tab 10.1 contains a 10.1-inch WXGA TFT (PLS) LCD touchscreen. (*See, e.g.*, APLNDC-Y0000060376.). The drive traces are located between the LCD and the sense traces (see figure below), and are widened to approximately 5 mm to substantially cover the second layer except for the etch gaps between adjacent drive traces to electrically isolate the sense traces from the device's LCD.

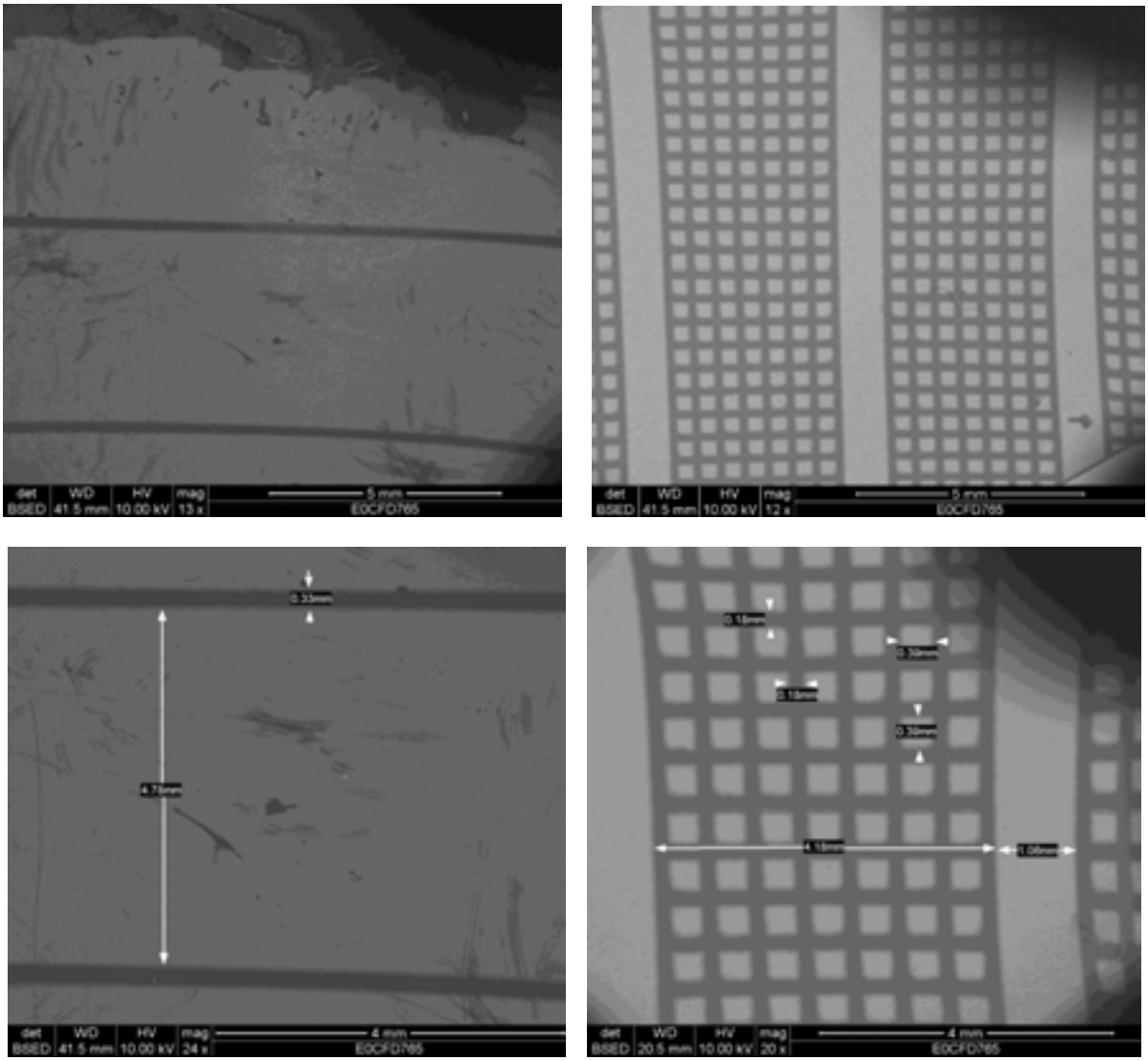


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the first or* <u>*sense*</u> *(top right) and second or* <u>*drive*</u> *set of traces (top left) of the Galaxy Tab 10.1 aligned along the X-Y plane as they are within the touchscreen. See Exhibit C-48; Exhibit C-50; Exhibit C-15; and Exhibit C-17. Note how the drive traces (4.78 mm, bottom left) have been widened approximately 5 mm to substantially cover the second layer except for the etch gaps (0.33 mm, bottom left) between adjacent drive traces to electrically isolate the sense traces (top and bottom right) from the device's LCD.*

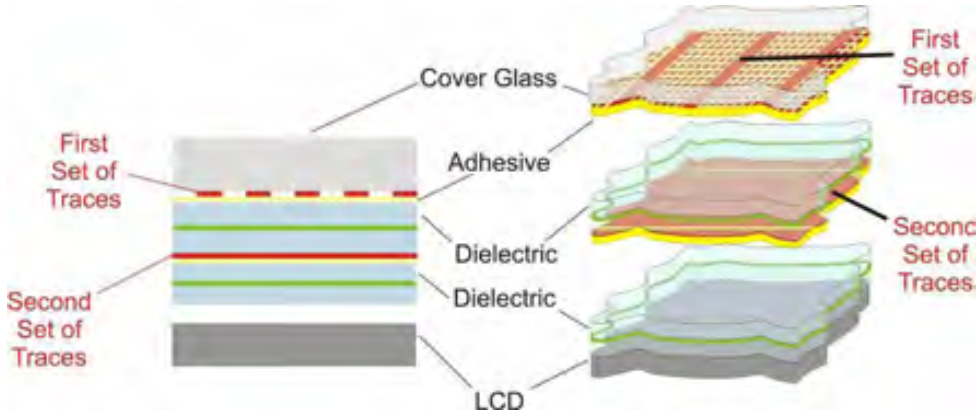


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touchpanel in cross-section (left) and isometric assembly view (right).*

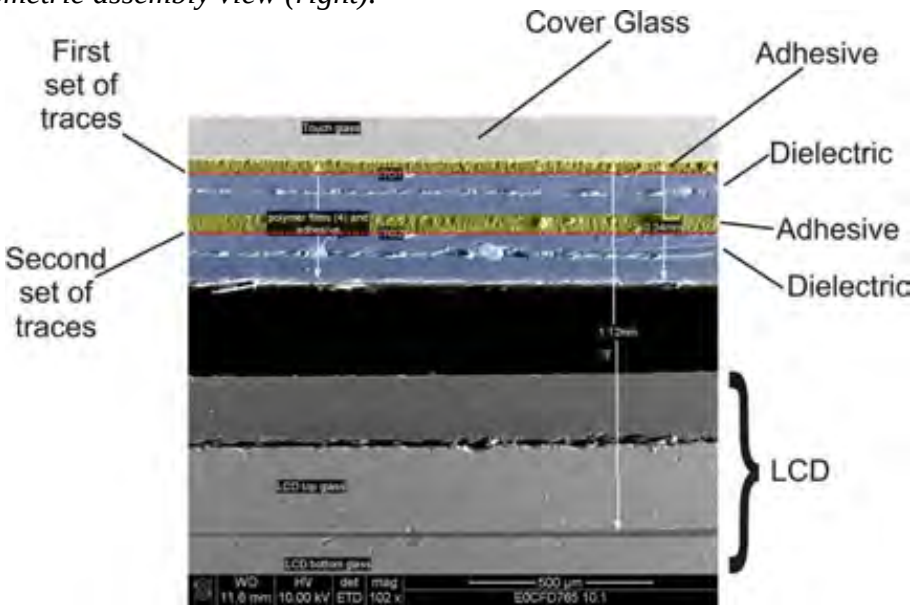


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing the various layers detailed in the schematic illustration, above. (Exhibit C-32.)*

259. The touch sensor panel of the Samsung Galaxy Tab 7.0 contains drive traces that are widened as compared to the sense traces to substantially cover the second layer except for a gap between adjacent drive traces so as to substantially electrically isolate the sense traces from a liquid crystal display (LCD). The Samsung Galaxy Tab 7.0 contains a 7" TFT LCD touchscreen. Tab User 7.0 Manual at APLNDC-Y0000063879. The drive traces are located between the LCD and the sense traces (see figure below), and are widened to approximately 5 mm to substantially

cover the second layer except for the etch gaps between adjacent drive traces to electrically isolate the sense traces from the device's LCD.

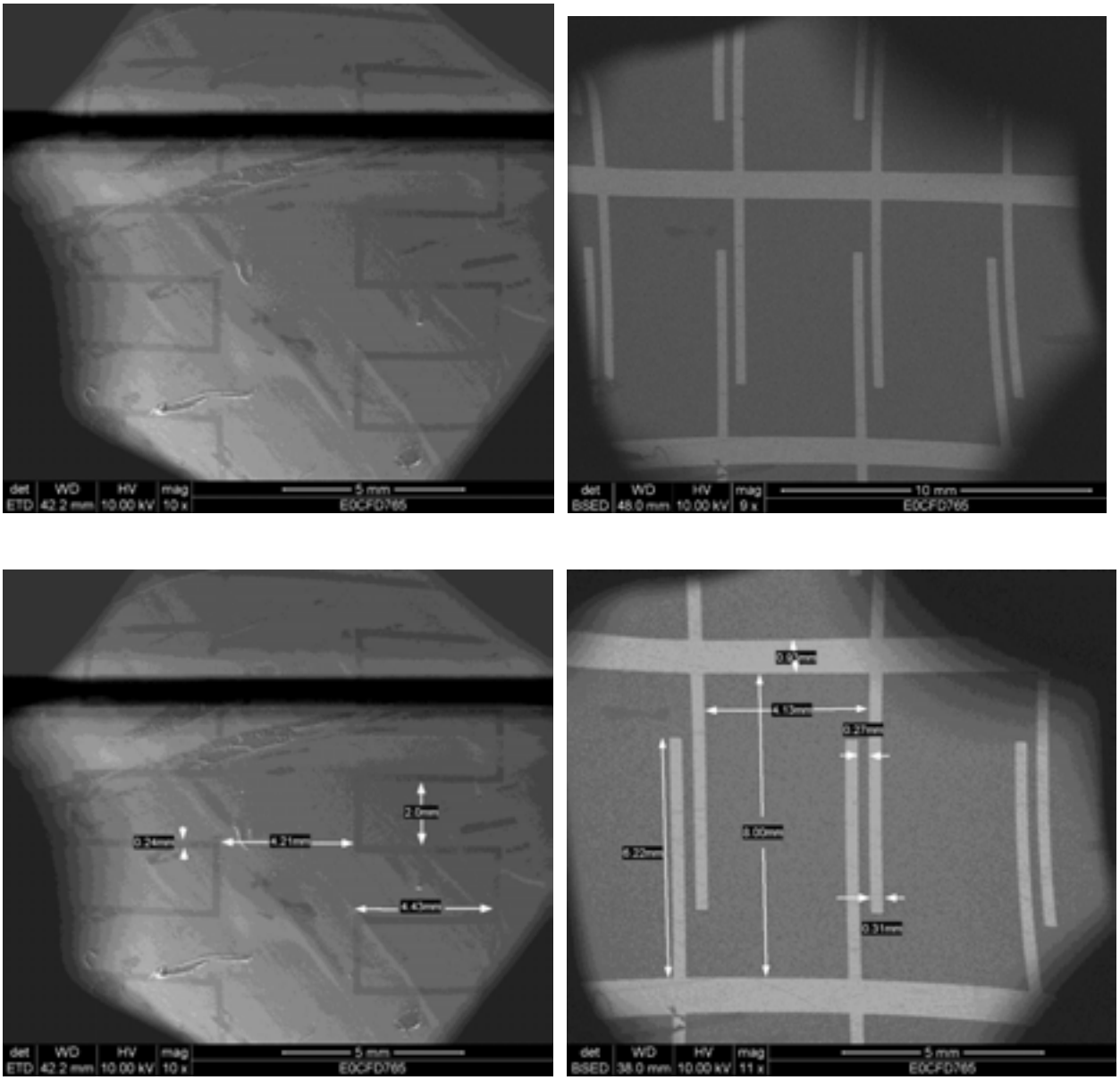


Figure. *Side by side comparison of Scanning Electron Micrographs (SEM) of the first or* <u>*sense*</u> *(top right) and second or* <u>*drive*</u> *set of traces (top left)of the Galaxy Tab 7.0 aligned along the X-Y plane as they are within the touchscreen. See Exhibit D-11; Exhibit D-12; Exhibit D-15; and Exhibit D-17. Note how the drive traces (4.21 mm, bottom left) have been widened approximately to substantially cover the second trace layer except for the etch gaps (0.24 mm, bottom left)*

between adjacent drive traces to electrically isolate the sense traces (top and bottom right) from the device's LCD.

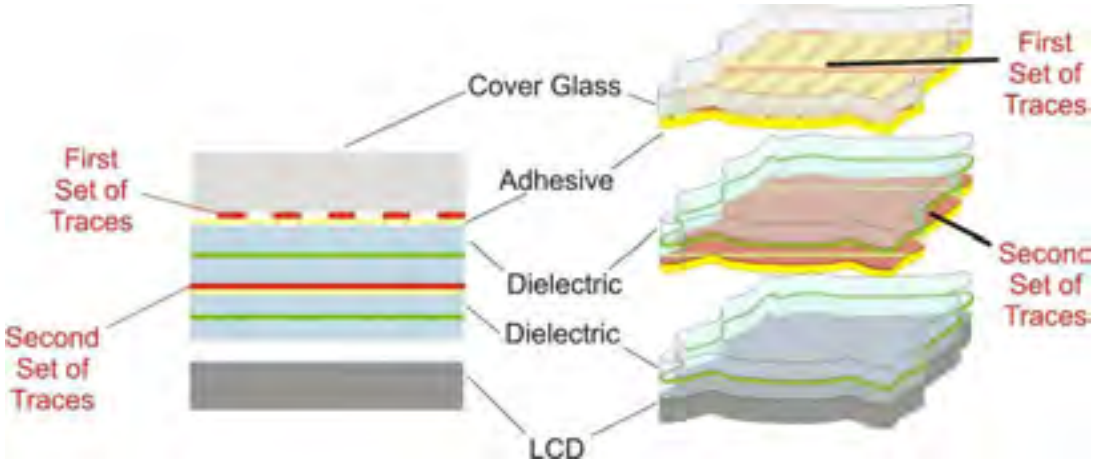


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in cross-section (left) and isometric assembly view (right).*

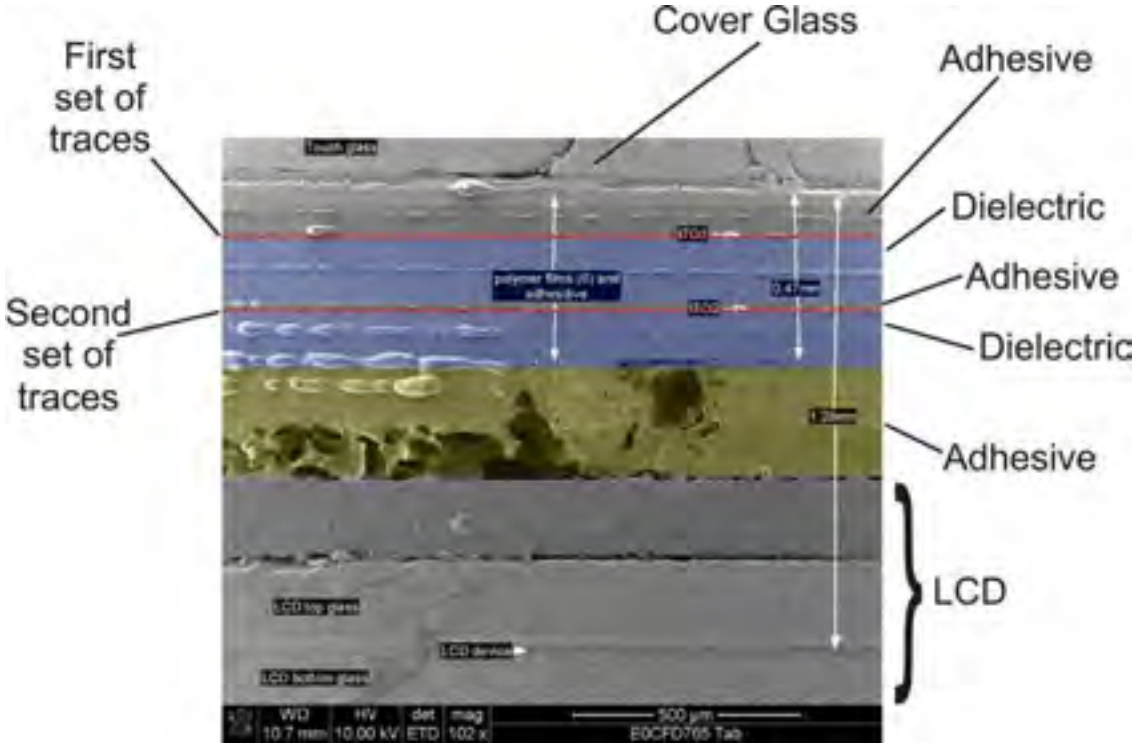


Figure. *Scanning Electron Micrograph of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing the various layers detailed in the schematic illustration, above. See Exhibit D-27.*

32. Claim 26: "wherein sensors are formed at locations at which the sense traces intersect with the drive traces"

260. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because in each ""wherein sensors are formed at locations at which the sense traces intersect with the drive traces." All of the Apple products I examined use a mutual capacitance sensing method in which sensors are formed at the intersections of the first set of traces and the second set of traces.

261. The Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices also meet these limitations. In the capacitive touch sensor panel of the Samsung Galaxy 10.1, sensors are formed at locations where the first set of traces intersects with the second set of traces while separated by the dielectric. Specifically, the Samsung Galaxy Tab 10.1 uses a touchscreen based on mutual capacitance, in which capacitive touch sensors are formed at each intersection of the two sets of traces (see Figure below).

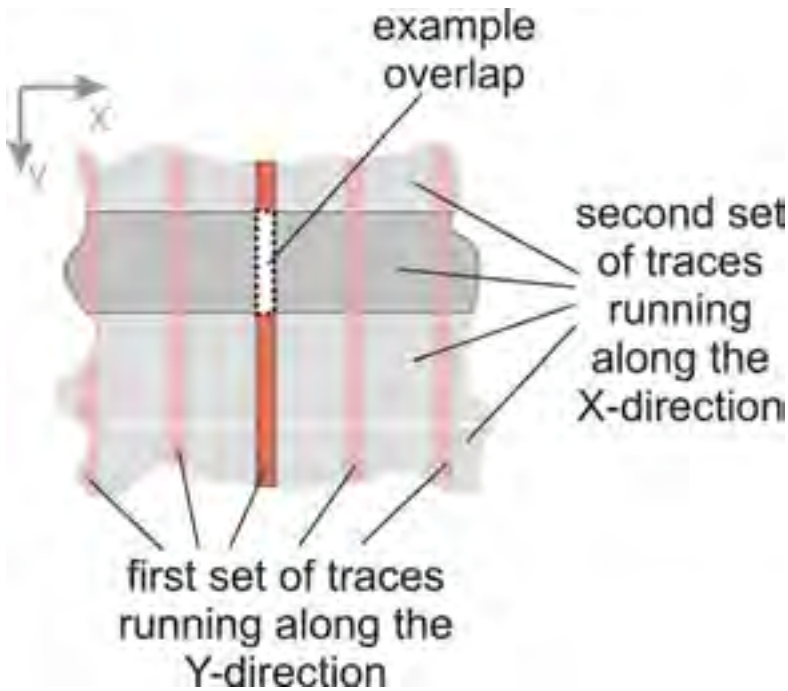


Figure. *Schematic representation of a Samsung Galaxy Tab 10.1 touchpanel in top and side view showing one example location where an overlap between the first set of traces and the second set results in a mutual capacitive touch sensor.*

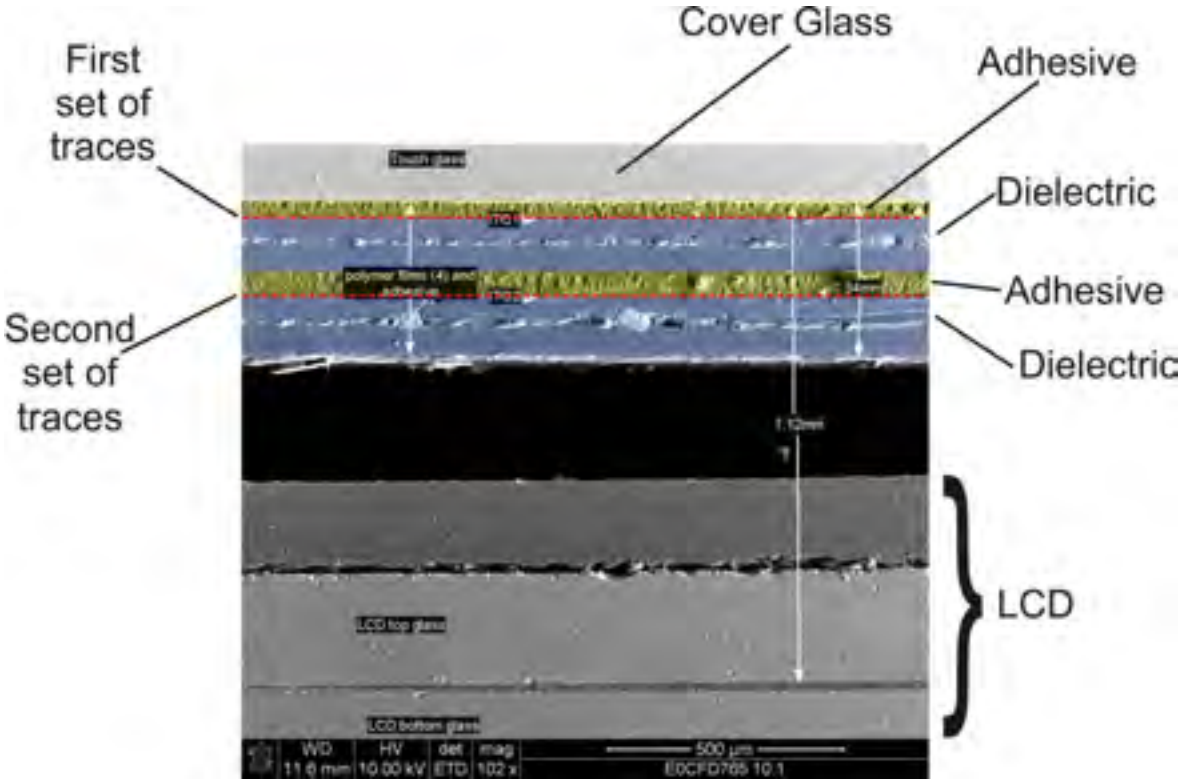


Figure. *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 10.1 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. See Exhibit C-32.*

262. In the capacitive touch sensor panel of the Samsung Galaxy Tab 7.0, sensors are formed at locations where the first set of traces intersects with the second set of traces while separated by the dilectric. Specifically, the Samsung Galaxy Tab 10.1 uses a touchscreen based on mutual capacitance, in which capacitive touch sensors are formed at each intersection of the two sets of traces (see Figure below).

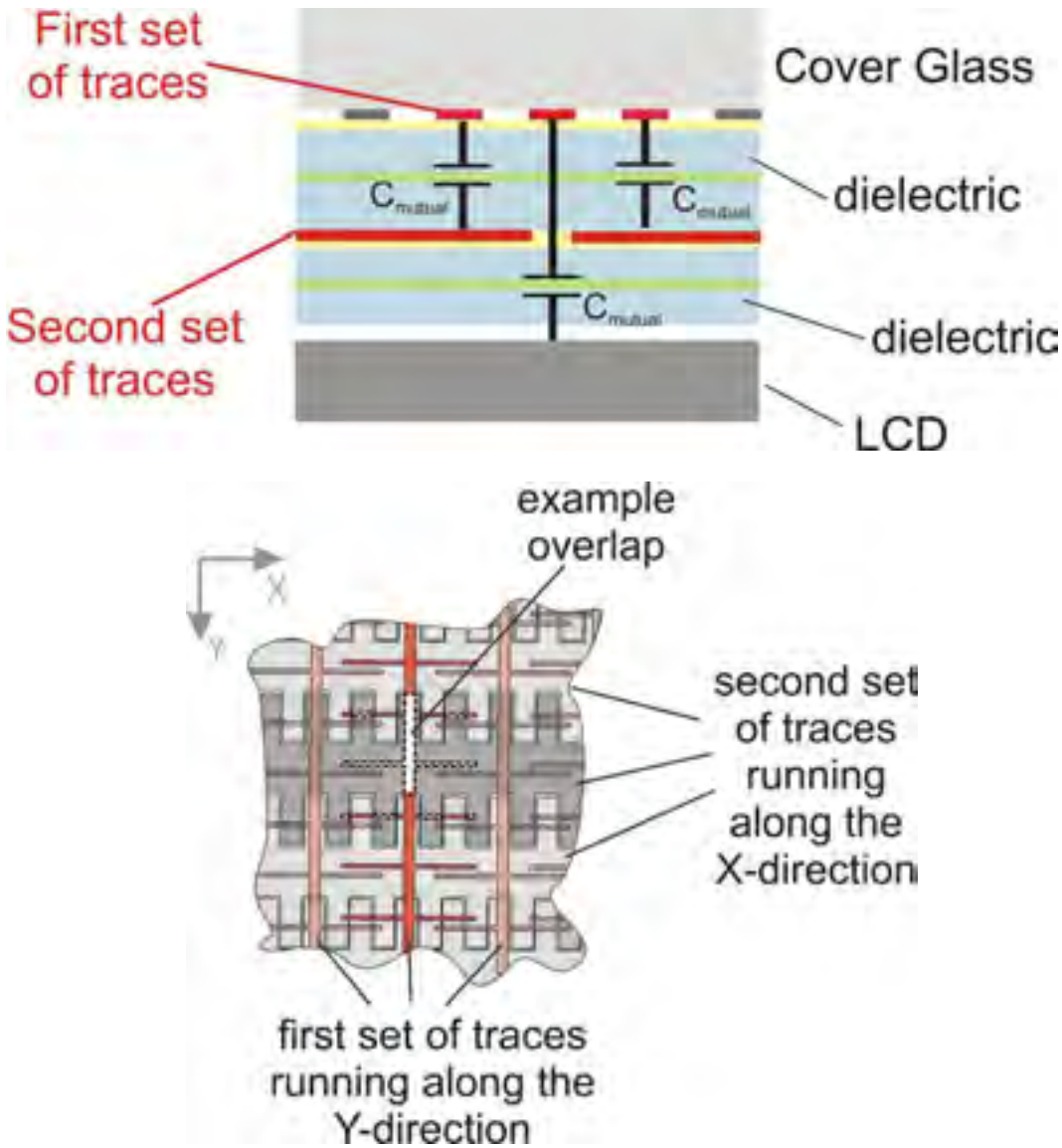
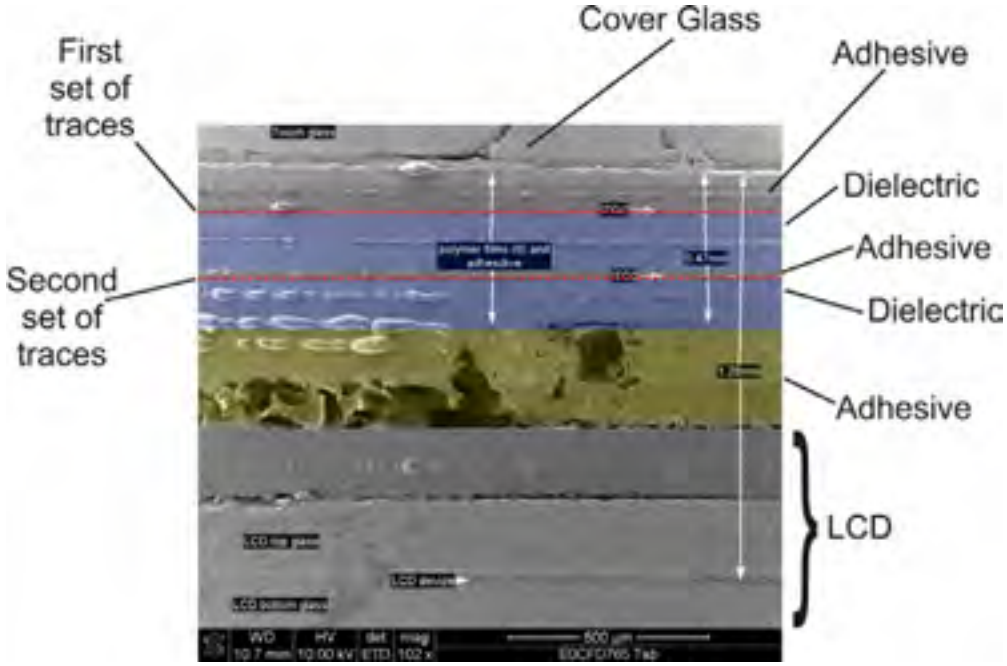


Figure. *Schematic representation of a Samsung Galaxy Tab 7.0 touchpanel in top and side view showing one example location where an overlap between the first and second traces results in a mutual capacitive touch sensor.*



263. **Figure.** *Scanning Electron Micrograph (SEM) of a cross-section through the Samsung Galaxy Tab 7.0 touchscreen and display showing that the first and second sets of traces are separated by a dielectric. (See Exhibit D-27.)*

33. Claim 26: "wherein each of the drive traces is of a substantially constant width."

264. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because in those Apple products "each of the drive traces is of a substantially constant width." In

all of the Apple products that I examined, the drive lines are deposited in ITO with substantially constant widths.

265. In the touch sensor panel of the Samsung Galaxy Tab 10.1, the drive traces are each of a substantially constant width, as illustrated below.

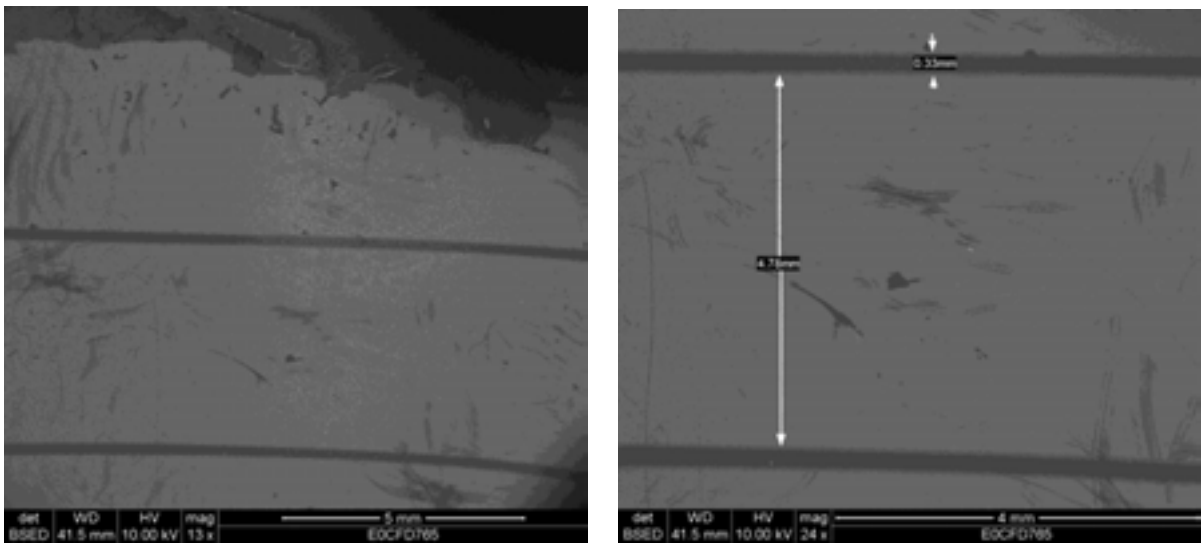


Figure. *Scanning Electron Micrographs (SEM) of the second or* <u>*drive*</u> *set of traces of the Galaxy Tab 10.1. Note how the drive traces have a substantially constant width. (See Exhibit C-48 and Exhibit C-50.)*

266. In the touch sensor panel of the Samsung Galaxy Tab 7.0, the drive traces are each of a substantially constant width, as illustrated below.

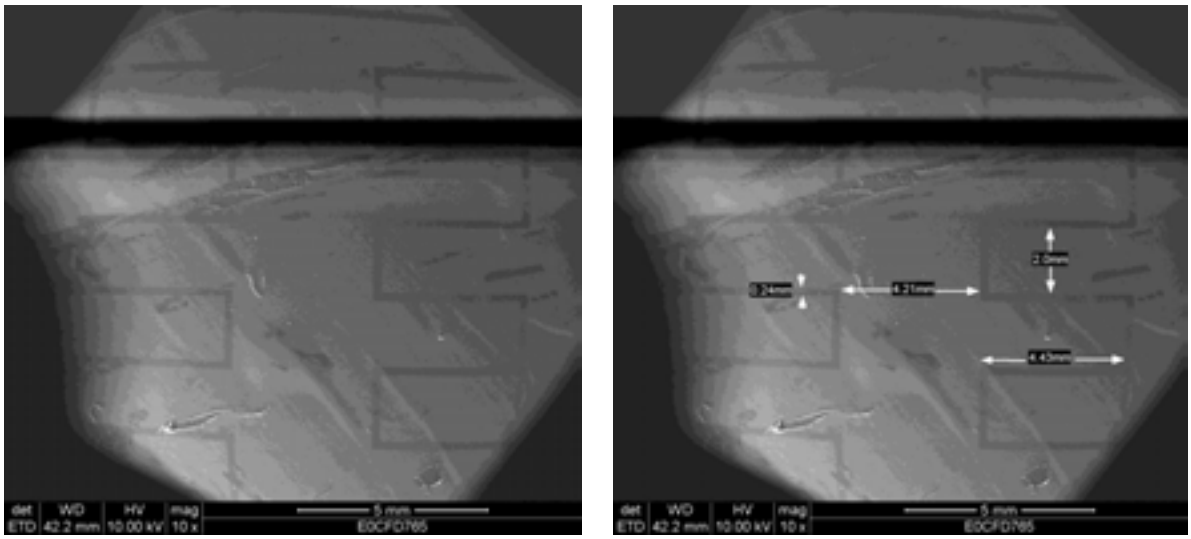


Figure. *Scanning Electron Micrographs (SEM) of the second or drive set of traces of the Galaxy Tab 7.0. Note how the drive traces have a substantially constant width. (See Exhibit D-11 and Exhibit D-12.)*

267. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 26 of the '129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

34. Claim 28: "The touch sensitive computing system of claim 26, wherein the computing system is incorporated into a media player."

268. I have spoken to the named-inventors of the '129 Patent claims who were working on designs for Apple's products when they conceived of their invention and I have examined the various Apple iPhone, iPod Touch, and iPad products sold in the U.S. and documents relating to their operation including, for example, [redacted] I conclude that those Apple products meet this limitation because in each "the computing system is incorporated into a media player." Each of the Apple iPhone and iPad products I examined included a digital audio player that incorporates a microprocessor and other computing components, such as memory, which is a computing system. This is self-evident from the functionality of the devices, which compute inputs, download music, video and other digital media content, and play a nearly infinite library of music and video through Apple's proprietary iTunes audio management and Apple's iTunes Store.

269. The touch sensitive computing system of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 further comprises a touch sensitive computing system wherein the computing

system is incorporated into a media player. More specifically, the Galaxy Tab 7.0 and Galaxy Tab 10.1 play high-definition video, as well as music and other audio files. (*See, e.g.*, APLNDC-Y0000060377; APLNDC-Y0000060436-446; APLNDC-Y0000065323; APLNDC-Y0000065355-56; APLNDC-Y0000065957-59; APLNDC-Y0000063927-932.) Further, the Media Hub application on the Galaxy Tab 7.0 allows one to purchase and download songs and albums. (*See, e.g.*, APLNDC-Y0000065362; APLNDC-Y0000065956.)

270. Because each of the Samsung Galaxy Tab 7.0 and Galaxy Tab 10.1 devices meets each and every limitation of claim 28 of the '129 Patent, I conclude that these products literally infringe that claim. In addition, since I do not know what, if any, arguments Samsung may raise to support a claim of non-infringement, I reserve the right to supplement or amend this analysis and add an explanation for infringement under the doctrine of equivalents if appropriate. I also conclude that since the Apple iPhone and iPad products meet the limitations, they embody the invention of this claim.

VII. ABSENCE OF DESIGN-AROUND AND NON-INFRINGING ALTERNATIVES

271. No equivalent alternative, non-infringing touchscreen technologies were in existence when the Samsung Galaxy Tab 10.1 entered the market in early 2011. At that time the problems that Samsung faced were that: (1) none of the alternative available touchscreen technologies afforded true multi-touch functionality; (2) none of the alternative display technologies to LCD was mature enough for use in tablet-size devices, and (3) using a touchscreen on top of an LCD panel was problematic because the display needed to have an extra layer of shielding to protect the sensitive touch screen electrodes from the electrical interference from the LCD. For these reasons, Samsung did not have a commercially viable alternative to these technologies embodied in the Apple iPad and iPhone products.

272. At the time Samsung entered the tablet market in early 2011, the available alternative transparent touchscreen technologies for use in an interactive user devices, like tablets and phones, could only perform limited touch functions. None of the available technologies offered reliable, robust multi-touch capability. In particular, resistive touchscreens had been in use for a while and did not provide true (multi-finger) multitouch. Samsung could have designed

a large-area ("pad" or "tablet") slate computer like the Galaxy Tab 7.0 and Tab 10.1 but would not have had the ability to track more than one, or perhaps, two touches. At the time, it is not at all clear that resistive type touch screens or prior capacitive touch screens could have accurately reflected contacts with the touch screen to enable natural, reliable multi-touch gestures. In this context, it is worth noting that Samsung has had a number of products which made use of resistive touchscreens (for example, the Samsung SGH-A867 'Eternity' smartphone contains 3.2" four-wire resistive touchscreen), none of which enabled multi-touch capability. None of the existing technologies were capable of providing true multitouch over large area displays and it seems clear that, given the consumer enthusiasm for the Apple iPad family, this functionality was highly valued and desired by consumers (and, thus, by Samsung).

273. Starting with the Samsung Impression (SGH-A877) phone in the United States, Samsung began offering touchscreens fabricated onto their Active Matrix Organic Light Emitting Diode (AMOLED) technology. For smaller screens, AMOLED displacement of LCD screens in Samsung products began in April of 2009 with the Impression and continued as the technology (and the required fabrication capacity) matured. Samsung's AMOLED technology (within the Samsung product family, successive improvements have produced a consecutive family of products named AMOLED, SuperAMOLED and SuperAMOLEDPlus) was not mature enough to offer a 7" and certainly not a 10" iPad-like offering when Samsung began its infringement in 2011 (although Samsung did introduce a 7.7" AMOLED display device later in early 2012). Indeed, Samsung still appears unable to scale up its AMOLED technology to larger size tablets because, for example, the Samsung 10.1 Tab still employs LCD technology.

274. These two constraints, the lack of suitable alternatives to an LCD screen for larger devices and the market-driven need for smooth, multi-finger, true multitouch, drastically limited the commercially viable options for Samsung. I conclude that mutual projected capacitance touch sensor panels (as taught by the '607 Patent) were, at the time of first infringement by Samsung, the only commercially viable alternatives for providing true multitouch in a "tablet" device like Samsung developed. It is evident that resistive, acoustic, IR and surface capacitance designs

either did not provide multitouch, were too costly, or were not sufficiently mature technologies at the time.

275. Note that although a necessary choice at the time, LCD panels interfered with the sensitivity of the capacitance touch sensors, which are susceptible to electrical interference or "noise" emitted by the LCD drive traces. For smaller screens (a few inches), this can be dealt with by reading the touch screen and refreshing the display image at different times. For example, if a device needs to refresh the image once every 15 ms (for visual quality), the display might be allowed 10 ms for refresh and the remaining 5 ms be used for touchscreen sensing. This happens fast enough (and often enough, ~60 times per second in my example) that the user does not notice the time multiplexing. For large displays, such as those used in the Samsung Tab and Samsung 10.1, however, this solution breaks down as the display itself requires longer times to refresh, not allowing enough time to read the touchscreen. Although the interference problem could be solved by adding an extra transparent "shielding layer" (usually made of the same ITO as the touchscreen traces) placed between the touchscreen and the display, that solution has the obvious drawback of reduced visual quality, added manufacturing cost, size, weight and system complexity (in terms of repair or modification). Instead, Samsung took the only commercially viable alternative approach of using the inventions claimed in the'129 Patent, namely, using the drive lines to shield the sense lines.

276. I conclude that mutual projected capacitance touch sensor panels (as taught by the '607 Patent) and the sense-line shielding configuration (as taught by the '129 Patent) that Apple employed in its products were, at the time of first infringement by Samsung, the only commercially viable alternatives for providing true multitouch in a "tablet" device like Samsung developed.

VIII. SAMSUNG'S COPYING OF APPLE'S PATENTED FEATURES

277. The overwhelming success of the Apple iPhone subsequent to its entry into the market in 2007 profoundly changed customer expectations of the features and interfaces expected in smartphones and, by extension, forced many technology manufacturers to adjust their strategic plans and tech development. Specifically with respect to the '607 and '129 Patents, it is clear that,

at the highest levels, Samsung realized the value of multi-touch technology (as demonstrated by the Apple family of products) and, by fall 2008, began to make company-wide efforts to begin copying the technology.

278. This view is strongly corroborated by email exchanges between Samsung project leads and the Samsung CEO. (SAMNDCA11374409-14) (*See* translation in Translations App'x.) For example, on September 16, 2008, Dong Jin Koh wrote:

> The CEO's words to the Head of the Office of Development and to the Product Planning Team Leader, during a business trip to America, are re-summarized as follows. Please note that the CEO's words below were relayed by the Head of the Office of Development. 'I am getting the sense that the Apple i-phone's Touch Method (C Type) is becoming the De facto Standard in the market. I think that we should *probably fully apply the C method* as well. *Isn't that the demand of the carriers and the market?* Excluding China, or the cases where there is no choice but to use the R method, let us think seriously about applying the C method. To apply the C method, the Icons would have to be large, and when viewing a screen with small letters, there would have to be a Zooming function, and……. I would like the executives in related areas to gather and have a discussion on this topic.' Therefore, we are trying to have the Product Planning/ UX/ R&D/ Sales executives gather and have a discussion and give a report after the CEO's return."

(SAMNDCA11374409.) (Emphasis added; 'C type' and 'C method' refer to Apple's multitouch touchscreens; 'R method' refers to Samsung's resistive touchscreens widely deployed in their phones at the time.)

279. On September 16, 2008, Samsung VP DongHoon Chang wrote: "I am once again putting this together because among the CEO's instructions, there was an instruction to compare the pros/cons of each Touch Type." (SAMNDCA11374411.) (*See* translation in Translations App'x.) Similarly, an email from Eunjung Chang (Senior Designer/Design Strategy(Mobile)/Samsung Electronics) makes clear the opinions of the European subsidiary concerning multitouch capabilities: "These are the results of the UX informational meeting which was held with the European subsidiaries last week (8th-11th)….. *Strongly requested multi-touch* (pinch interaction). *Informed us of the market's need* for this in a variety of features such as browser, game, photo. (They feel that whether this is installed in a product is an important factor

when customers make purchases because it is convenient and fun)" (SAMNDCA10015271-5279.) (*See* translation in Translations App'x.) (emphasis added).

280. Beginning around December 2008, rumors abounded of a large format Apple offering with a touchscreen (*i.e.* a tablet computer) similar to an iPhone, but larger. These rumors persisted and grew through early 2009. See http://techcrunch.com/tag/ipad/page/57/, http://techcrunch.com/tag/ipad/page/56/, http://techcrunch.com/tag/ipad/page/55/, http://techcrunch.com/tag/ipad/page/54/, (accessed March, 13 2012) (APLNDC-Y0000234058-83).

281. Documents I have reviewed indicate that through 2009, Samsung produced teardowns of the iPhone and other competitor phones. Samsung compared iPhone display and touchscreen structure (including the layer stack of the iPhone) with various Samsung phones. SAMNDCA10281750-56. (*See* translation of excerpts in Translations App'x.) Teardowns also included comparisons between resistive and capacitive touchscreen structure and performance. (*Id.*; SAMNDC10890609-631; SAMNDCA10890091-95.) (*See* translation of excerpts in Translations App'x.)

282. Communication between Samsung and Atmel Quantum in March 2009 shows that Samsung received information concerning the operation of Atmel Quantum's mutual capacitance touchscreens. An Atmel Quantum presentation to Samsung outlined advantages of mutual capacitance touchscreens, including a "no shield" strategy relying on an "X layer" shielding a "Y layer" from LCD noise and why alternatives to mutual capacitance designs would not produce multitouch. (*See, e.g.*, SAMNDCA10903827-70.) Atmel Quantum provided specific information concerning what Atmel Quantum believed to be the iPhone's "superior performance" relating to mutual capacitance sensor structure. (*See, e.g.*, SAMNDCA10765465-66.) (*See* translation in Translations App'x.) The Apple iPad was released in the United States in April 2010 with a 9.7" touchscreen display and a 13 mm thickness.

283. On April 30, 2010, Samsung produced a teardown and comparison between Samsung's GT-P1000 (later sold as the Galaxy Tab 7.0) and the Apple iPad. (SAMNDCA10281869–86.)

284. The documents I have reviewed indicate that during mid-2010, Samsung continued to compare Apple's mutual capacitance touchscreens with their own products including layer stack analysis. (SAMNDCA10281778-89; SAMNDCA10913717-18.) (*See* translation of excerpts in Translations App'x.)

285. The Samsung Galaxy Tab 7.0 was released in the United States on September 2, 2010 with a 7" touchscreen display and an 11.98 mm thickness. On January 20, 2011, Samsung compared the P1 (Galaxy Tab 7.0) touchscreen with the iPad touchscreen. (SAMNDCA11003887.)

286. The Samsung Galaxy Tab 10.1, later called the Samsung Galaxy Tab 10.1v, was shown on February 13, 2011 at the Samsung Unpacked event – with a 10.1" touchscreen display and a 10.9 mm thickness. It was initially slated for March 2011 release.

287. The Apple iPad 2 was released on March 11, 2011 (US) – with 9.7" touchscreen display and an 8.6 mm thickness. The Samsung Galaxy Tab 10.1 was not released until after the Apple iPad 2's release. According to Yonhap News Agency on March 4, 2011, "Lee Don-joo, executive vice president of Samsung's mobile division, said that Apple has presented new challenges for the South Korean company with a thinner mobile gadget that is priced the same as its predecessor. 'We will have to improve the parts that are inadequate,' Lee told Yonhap News Agency. 'Apple made it very thin.'" (APLNDC-Y0000234090 (accessed March 13, 2012 (http://english.yonhapnews.co.kr/techscience/2011/03/04/9/0601000000AEN20110304009300320F.HTML).

288. Through March 30, 2011, Samsung continued to compare the touchscreens for its proposed devices, the P1 (Samsung Galaxy Tab 7.0), P3 (Samsung Galaxy Tab 10.1v), P4 (Samsung Galaxy Tab 10.1), P5 (Samsung Galaxy Tab 8.9), P7 (Samsung Galaxy Tab 7.3), and the Apple iPad and iPad 2. Layer stacks are provided for all six touchscreens showing a design and manufacturing progression across prototypes. For the P1, S-MAC was the TSP supplier and Atmel controllers were used. For the P3/4, J-Touch was a supplier and Atmel controllers were used. (SAMNDCA11003931-33.) On June 11, 2011, the Samsung Galaxy Tab 10.1 was released – with a 10.1" touchscreen display and an 8.6 mm thickness.

289. Based on these and other documents that I have reviewed and the series of events described within those documents, it is my conclusion that Samsung took steps to determine what technology Apple used in the Apple iPhone and iPad and adopted a touchscreen design and arrangement substantially similar to Apple's in its own products and specifically chose to use the features in Apple's products that are claimed in the asserted claims of the '607 and '129 Patents as discussed above.

IX. CONCLUSION

290. As I noted above, I have not had full and complete access to relevant information from Samsung, third parties, and other experts, and there may be future rulings from the Court that may impact the evidence or law to be applied in this case. I understand that there are current outstanding discovery issues relating to Samsung's and third-party document production. I understand there are also still depositions remaining to be completed. Consequently, I reserve the right to supplement, amend or otherwise modify my opinions in view of any such new information.

291. My opinions are subject to change based on additional opinions that Samsung's experts may present and information I may receive in the future or additional work I may perform. With this in mind, based on the analysis I have conducted and for the reasons set forth below, I have preliminarily reached the conclusions and opinions in this report.

292. In connection with my anticipated testimony in this action, I may use as exhibits various documents produced in this Action that refer or relate to the matters discussed in this report. I have not yet selected the particular exhibits that might be used. In addition, I may create or assist in the creation of certain demonstrative exhibits to assist in the presentation of my testimony and opinions as described herein or to summarize the same or information cited in this report. Again, those exhibits have not yet been created.

Dated: March 22, 2012

Michel Maharbiz