

SCORE Placeholder Sheet for IFW Content

Application Number: 16742230

Document Date: 01/14/2020

The presence of this form in the IFW record indicates that the following document type was received in electronic format on the date identified above. This content is stored in the SCORE database.

Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

- Drawing

At the time of document entry (noted above):

- USPTO employees may access SCORE content via DAV or via the SCORE web page.
- External customers may access SCORE content via PAIR using the Supplemental Content tab.

UTILITY PATENT APPLICATION TRANSMITTAL
(Only for new nonprovisional applications under 37 CFR 1.53(b))

I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on January 14, 2020 at or before 11:59 p.m. Eastern Standard Time under the Rules of 37 CFR § 1.10.



Si Vuong

Docket No. : 183539
Inventor(s) : Chiwook An, et al.
Title : DISPLAY DEVICE

ADDRESS TO: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

January 14, 2020

1. ☒ **FEE TRANSMITTAL FORM**

2. **IF A CONTINUING APPLICATION**

☒ This application is a continuation of patent application No. 15/660,827.

Prior application information: Examiner Towfiq Elahi; Group Art Unit: 2625.

_____ This application claims the benefit of Provisional Application No. _____ pursuant to 35 U.S.C. §119(e) and 37 CFR §1.78(a)(4).

3. **APPLICATION COMPRISED OF**

Specification

45 Specification, claims and Abstract (total pages)

Drawings

32 Sheets of formal drawing(s) (FIGS. 1A to 16)

Inventor's Declaration(s)

_____ Executed Declaration (new or copy from a prior application (37 CFR 1.63(d)) (for continuation and divisional)

☒ Executed Declaration/Assignment (new or copy from a prior application (37 CFR 1.63(d)) (for continuation and divisional)

Power of Attorney by Applicant(s)

☒ Executed (new or copy from a prior application (37 CFR 1.63(d)) (for continuation and divisional) with transmittal

Application Data Sheet

☒ Newly executed ADS

_____ Unexecuted ADS

4. _____ **Microfiche Computer Program (Appendix)**

UTILITY PATENT APPLICATION TRANSMITTAL
(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.: 183539

5. ☐ **Nucleotide and/or Amino Acid Sequence Submission** (if applicable, all necessary)
☐ Computer Readable Copy
☐ Paper Copy (identical to computer copy)
☐ Statement verifying identity of above copies
6. **APPLICANT(S) STATUS UNDER 37 CFR § 1.27 or 1.29**
☐ Applicant(s) and any others associated with it/them under § 1.27(a) are a SMALL ENTITY
☐ Applicant(s) and any others associated with it/them under § 1.29(a) are a MICRO ENTITY
☐ Certification of Micro Entity Status (Gross Income Basis)
7. **ALSO ENCLOSED ARE**
☐ Request and Certificate under 35 U.S.C. §122(b)(2)(B)(i) (**Request for Non-Publication**)
☐ Preliminary Amendment
☐ Includes "Cross-Reference to Related Applications"
☐ A Petition for Extension of Time for the parent application and the required fee are being filed concurrently herewith.
☐ This application is owned by _____ pursuant to an Assignment recorded at Reel _____, Frame _____
☒ Information Disclosure Statement (IDS)
☐ Copies of IDS Citations
☐ Certified copy of Priority Document(s) (paper filing only, if foreign priority is claimed)
☐ English Translation Document (if applicable)
☐ Return Receipt Postcard (MPEP 503) (should be specifically itemized).
☐ Other: _____
8. **DIRECT ALL CORRESPONDENCE TO: CUSTOMER NUMBER 23363**

Respectfully submitted,

LEWIS ROCA ROTHGERBER CHRISTIE LLP

By


Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

LEWIS ROCA ROTHGERBER CHRISTIE LLP, P.O. BOX 29001, GLENDALE, CA 91209-9001

DATE: January 14, 2020

Duplicate ____

CLAIMS AS FILED							
	Number Filed	Number Extra	Large Entity Rate	Small Entity Rate	Micro Entity Rate	Fee	
Total Claims	16 – 20	= 0	0 x \$100.00	\$50.00	\$25.00	\$0.00	
Independent Claims	1 – 3	= 0	0 x \$460.00	\$230.00	\$115.00	\$0.00	
Multiple-Dependent Claims Fee			\$820.00	\$410.00	\$205.00	\$0.00	
BASIC FILING, SEARCH, AND EXAMINATION FEES							
			Large Entity Rate	Small Entity Rate	Micro Entity Rate	Fee	
Basic Filing Fee			\$300.00	\$75.00	\$75.00	\$300.00	
Search Fee			\$660.00	\$330.00	\$165.00	\$660.00	
Examination Fee			\$760.00	\$380.00	\$190.00	\$760.00	
APPLICATION SIZE FEE							
EFS Paper Size Equivalent	Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round up to whole number)	Large Entity Rate	Small Entity Rate	Micro Entity Rate	Fee
77 * .75	= 58 – 100	= 0/50	= 0	0 x \$400.00	\$200.00	\$100.00	\$0.00
OTHER							
			Large Entity Rate	Small Entity Rate	Micro Entity Rate	Fee	
Late Submission of Oath/Declaration Fee			\$160.00	\$80.00	\$40.00	\$0.00	
Non-Electronic Filing Fee			\$400.00	\$200.00	\$200.00	\$0.00	
					TOTAL AMOUNT OF FEES		
List Independent Claims: 1					\$1,720.00		

 X Submitted herewith is the fee of \$1,720.00.

 X The Commissioner is hereby authorized to charge any fees under 37 CFR 1.16 and 1.17 which may be required during the **entire pendency** of the application to Deposit Account No. 03-1728. Please show our docket number with any charge or credit to our Deposit Account.

LEWIS ROCA ROTHGERBER CHRISTIE LLP

JEJ/smv

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on January 14, 2020 at or before 11:59 p.m. Eastern Standard Time under the Rules of 37 CFR § 1.10.



Si Vuong

Inventor : Chiwook An, et al.
Application No. : To Be Determined
Filed : January 14, 2020
Title : DISPLAY DEVICE

Grp./Div. : To Be Determined
Examiner : To Be Determined

Docket No. : 183539

**TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS
IN ACCORDANCE WITH 37 CFR 1.5**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
January 14, 2020

Commissioner:

Attached herewith is a General Power of Attorney for the above-identified patent application.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By _____
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/smv

110231960.1 01/13/20 4:51PM

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number

Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)



I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

23363

OR



I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:



The address associated with the above-mentioned Customer Number

OR



The address associated with Customer Number:

OR

Firm or
Individual Name

Address

City

State

Zip

Country

Telephone

Email

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

SAMSUNG DISPLAY CO., LTD.



Inventor or Joint Inventor (title not required below)



Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)



Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)



Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature

Date (Optional)

Name

Dong-Ho Lee

Title

Group Leader, IP Prosecution Group

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.



Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

**INVENTOR'S DECLARATION AND ASSIGNMENT
FOR PATENT APPLICATION**

Docket No.: 130852

**INVENTOR'S DECLARATION AND ASSIGNMENT
FOR PATENT APPLICATION**

PATENT

Title of Invention: DISPLAY DEVICE
Docket No.: 130852

INVENTOR'S DECLARATION

As a below named inventor, I hereby declare that:

This declaration is directed to the attached application unless the following is checked:

☐ United States Application or PCT International Application Number _____
filed on _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the above-identified application.

I have reviewed and understand the contents of the above-identified application, including the claims.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. § 1001 by fine or imprisonment of not more than five (5) years, or both.

ASSIGNMENT

In consideration of good and valuable consideration, the receipt of which is hereby acknowledged, the undersigned,

(1) Chiwook AN, Doyeon KIM, Sunghyun PARK, Jaehyun LEE, and Sung-woong CHO

HEREBY SELL(S), ASSIGN(S) AND TRANSFER(S) TO

(2) SAMSUNG DISPLAY CO., LTD.

having a place of business at

(3) 1, Samsung-Ro, Giheung-Gu, Yongin-Si, Gyeonggi-Do, Korea

SDC Ref No. LO-201607-175-1-US0

Attorney Ref No. 130852 (411598-02694)

COMBINED DECLARATION (37 CFR 1.63) FOR UTILITY PATENT APPLICATION AND ASSIGNMENT FORM
KORYO IP & LAW

**INVENTOR'S DECLARATION AND ASSIGNMENT
FOR PATENT APPLICATION**

Docket No.: 130852

(hereinafter called "ASSIGNEE") the entire right, title and interest in and to any and all improvements which are disclosed in the application for United States Letters Patent entitled

(4) DISPLAY DEVICE

which application executed on even date herewith or was

(a) executed on (5a): _____;

(b) filed on (5b): _____;

Application No.: _____;

(LEWIS ROCA ROTHGERBER CHRISTIE
LLP, 29001, Glendale, CA 91209-9001) is
hereby authorized to insert in (b) the specified
data, when known.

including any and all United States Patents which may be granted on said application, and any and all extensions, divisions, reissues, substitutes, renewals or continuations of said application and patents, and the right to all benefits under all international conventions for the protection of industrial property and applications for said improvements.

It is hereby authorized and requested that the Commissioner of Patents issue any and all of said Letters Patent, when granted, to said ASSIGNEE, its assigns or its successors in interest or its designee.

Upon said consideration, it is further agreed that, when requested, without charge to but at the expense of said ASSIGNEE, the undersigned will execute all divisional, continuing, substitute, renewal, and reissue patent applications; execute all rightful other papers; and generally do everything possible which said ASSIGNEE shall consider desirable for aiding in securing and maintaining patent protection as provided herein.

Chiwook AN
Legal Name of Inventor

17.7.3
Date

Chiwook AN
Signature

Doyeon KIM
Legal Name of Inventor

17.2.3
Date

Doyeon KIM
Signature

SDC Ref No. **LO-201607-175-1-US0**

Attorney Ref No. **130852 (411598-02694)**

COMBINED DECLARATION (37 CFR 1.63) FOR UTILITY PATENT APPLICATION AND ASSIGNMENT FORM
KORYO IP & LAW

INVENTOR'S DECLARATION AND ASSIGNMENT
FOR PATENT APPLICATION

Docket No.: 130852

Sunghyun PARK
Legal Name of Inventor

2. 3. 17
Date

Sunghyun Park
Signature

Jaehyun LEE
Legal Name of Inventor

17. 2. 3
Date

Jaehyun LEE
Signature

Sung-woong CHO
Legal Name of Inventor

17. 2. 3
Date

Sung-woong cho
Signature

AM PAS1446081.1 * 10/24/16 3:16 PM

SDC Ref No. LO-201607-175-1-US0

Attorney Ref No. 130852 (411598-02694)

COMBINED DECLARATION (37 CFR 1.63) FOR UTILITY PATENT APPLICATION AND ASSIGNMENT FORM
KORYO IP & LAW

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	183539/411598-04552
		Application Number	
Title of Invention	DISPLAY DEVICE		
<small>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</small>			

Secrecy Order 37 CFR 5.2:

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--------------------------	---

Inventor Information:

Inventor	1				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Chiwook		AN		
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service					
City	Hwaseong-si		Country of Residence ⁱ	KR	
Mailing Address of Inventor:					
Address 1	1463-1004, 122, Dongtandaerosibeom-gil				
Address 2					
City	Hwaseong-si, Gyeonggi-do		State/Province		
Postal Code		Country ⁱ	KR		
Inventor	2				Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Doyeon		KIM		
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service					
City	Seoul		Country of Residence ⁱ	KR	
Mailing Address of Inventor:					
Address 1	#401, 723-2, Hannam-dong, Yongsan-gu				
Address 2					
City	Seoul		State/Province		
Postal Code		Country ⁱ	KR		
Inventor	3				Remove
Legal Name					

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	183539/411598-04552
		Application Number	
Title of Invention	DISPLAY DEVICE		

Prefix	Given Name	Middle Name	Family Name	Suffix
	Sunghyun		PARK	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Seongnam-si	Country of Residence ⁱ	KR	

Mailing Address of Inventor:

Address 1	607-1404, 54, Naejeong-ro, Bundang-gu			
Address 2				
City	Seongnam-si, Gyeonggi-do	State/Province		
Postal Code		Country ⁱ	KR	
Inventor	4			Remove
Legal Name				

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jaehyun		LEE	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Seoul	Country of Residence ⁱ	KR	

Mailing Address of Inventor:

Address 1	#202, Uyeong villa, 1198-26, Sinjeong 2-dong			
Address 2	Yangcheon-gu			
City	Seoul	State/Province		
Postal Code		Country ⁱ	KR	
Inventor	5			Remove
Legal Name				

Prefix	Given Name	Middle Name	Family Name	Suffix
	Sung-woong		CHO	
Residence Information (Select One) US Residency ☒ Non US Residency Active US Military Service				
City	Asan-si	Country of Residence ⁱ	KR	

Mailing Address of Inventor:

Address 1	303-3805, Tangjeong Samsung Trapalace Apt.			
Address 2	Myeong-am-ri, Tangjeong-myeon			
City	Asan-si, Chungcheongnam-do	State/Province		
Postal Code		Country ⁱ	KR	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	183539/411598-04552
		Application Number	
Title of Invention	DISPLAY DEVICE		

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.

Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ An Address is being provided for the correspondence information of this application.

Customer Number	23363		
Email Address	pto@lrrc.com	Add Email	Remove Email

Application Information:

Title of the Invention	DISPLAY DEVICE		
Attorney Docket Number	183539/411598-04552	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	32	Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	183539/411598-04552
		Application Number	
Title of Invention	DISPLAY DEVICE		
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	23363		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	15/660827	2017-07-26
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Remove
10-2016-0097493	KR	2016-07-29	Access Code ⁱ (if applicable)
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	183539/411598-04552
		Application Number	
Title of Invention	DISPLAY DEVICE		

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	183539/411598-04552
		Application Number	
Title of Invention	DISPLAY DEVICE		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant	1 Remove		
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section. Clear			
☒ Assignee	Legal Representative under 35 U.S.C. 117		Joint Inventor
Person to whom the inventor is obligated to assign.		Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
<div></div>			
Name of the Deceased or Legally Incapacitated Inventor: <div></div>			
If the Applicant is an Organization check here. ☒			
Organization Name	SAMSUNG DISPLAY CO., LTD.		
Mailing Address Information For Applicant:			
Address 1	1, Samsung-ro, Giheung-gu		
Address 2			
City	Yongin-si, Gyeonggi-do	State/Province	
Country	KR	Postal Code	17113
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	183539/411598-04552
		Application Number	
Title of Invention	DISPLAY DEVICE		

Assignee 1				
Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.				
<input type="button" value="Remove"/>				
If the Assignee or Non-Applicant Assignee is an Organization check here. ☐				
Prefix	Given Name	Middle Name	Family Name	Suffix
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Mailing Address Information For Assignee including Non-Applicant Assignee:				
Address 1		<input type="text"/>		
Address 2		<input type="text"/>		
City	<input type="text"/>	State/Province	<input type="text"/>	
Country i	<input type="text"/>	Postal Code	<input type="text"/>	
Phone Number	<input type="text"/>	Fax Number	<input type="text"/>	
Email Address	<input type="text"/>			
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. <input type="button" value="Add"/>				

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Jun-Young E. Jeon/		Date (YYYY-MM-DD)	2020-01-14
First Name	Jun-Young E.	Last Name	Jeon	Registration Number
				43693
Additional Signature may be generated within this form by selecting the Add button. <input type="button" value="Add"/>				

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	183539/411598-04552
		Application Number	
Title of Invention	DISPLAY DEVICE		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

1 183539/411598-04552

ABSTRACT

5 A display device includes a display panel, and a touch sensing unit on the display panel, the touch sensing unit including a first conductive pattern on the display panel, an insulating layer covering the first conductive pattern, and a second conductive pattern on the insulating layer, partially crossing the first conductive pattern, and having a thickness that is greater than a thickness of the first conductive pattern.

10

15

110231633.1 01/13/20 4:15PM

20

25

WHAT IS CLAIMED IS:

- 5 1. A display device comprising:
an organic light emitting device layer;
a thin film encapsulation layer on the organic light emitting device layer;
a buffer layer directly on the thin film encapsulation layer; and
a touch sensing unit directly on the buffer layer, the touch sensing unit
10 comprising:
a first conductive pattern on the buffer layer;
an insulating layer covering the first conductive pattern; and
a second conductive pattern on the insulating layer, the second
conductive pattern partially crossing the first conductive pattern, and having a
15 thickness that is greater than a thickness of the first conductive pattern.
2. The display apparatus of claim 1, wherein the first conductive pattern is
directly on the buffer layer.
- 20 3. The display apparatus of claim 1, wherein the buffer layer comprises at
least one of a silicon nitride, a silicon-oxy-nitride, and a silicon oxide.
4. The display apparatus of claim 1, wherein the thin film encapsulation
layer comprises:
25 a first inorganic layer;
an organic layer on the first inorganic layer; and
a second inorganic layer on the organic layer.

1 183539/411598-04552

5. The display apparatus of claim 4, wherein the buffer layer is directly on the second inorganic layer.

5

6. The display apparatus of claim 1, wherein the first conductive pattern comprises:

a first conductive layer on the buffer layer;
a second conductive layer on the first conductive layer; and
10 a third conductive layer on the second conductive layer, and
wherein the second conductive pattern comprises:

a fourth conductive layer on the insulating layer;
a fifth conductive layer on the fourth conductive layer; and
15 a sixth conductive layer on the fifth conductive layer.

15

7. The display apparatus of claim 6, wherein each of the second conductive layer and the fifth conductive layer comprises aluminum (Al), and

wherein each of the first conductive layer, the third conductive layer, the fourth conductive layer and the sixth conductive layer comprises titanium (Ti).

20

8. The display apparatus of claim 6, wherein a thickness of the second conductive layer is greater than each of a thickness of the first conductive layer and a thickness of the third conductive layer.

25 9. The display apparatus of claim 6, wherein a thickness of the fifth conductive layer is greater than each of a thickness of the fifth conductive layer and a thickness of the sixth conductive layer.

10. The display apparatus of claim 6, wherein a thickness of the second
conductive layer is less than a thickness of the fifth conductive layer.

5

11. The display apparatus of claim 6, wherein a thickness difference between
the second conductive layer and the first conductive layer is greater than a thickness
difference between the third conductive layer and the first conductive layer.

10

12. The display apparatus of claim 6, wherein a thickness difference between
the fifth conductive layer and the fourth conductive layer is greater than a thickness
difference between the sixth conductive layer and the fourth conductive layer.

15

13. The display apparatus of claim 6, wherein a thickness difference between
the fifth conductive layer and the fourth conductive layer is greater than a thickness
difference between the second conductive layer and the first conductive layer.

14. The display apparatus of claim 1, wherein the second conductive pattern
comprises:

20

first touch sensor parts;
second touch sensor parts spaced from the first touch sensor parts; and
first connection parts connecting respective ones of the first touch sensor parts,
wherein the first conductive pattern comprises electrically conductive second
connection parts connecting respective ones of the second touch sensor parts.

25

15. The display apparatus of claim 14, wherein the second connection parts
are directly on the buffer layer.

1 183539/411598-04552

16. The display apparatus of claim 1, wherein a thickness of the insulating
layer is less than a thickness of the second conductive pattern.

5

10

15

20

25

DISPLAY DEVICE

5 CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation of U.S. Patent Application No. 15/660,827, filed July 26, 2017, which claims priority to and the benefit of Korean Patent Application No. 10-2016-0097493, filed July 29, 2016, the entire content of both of which is incorporated herein by reference.

10

BACKGROUND

1. Field

[0002] The present disclosure relates to a display device capable of preventing a crack in an insulating layer included in a touch sensing unit.

15

2. Description of the Related Art

[0003] In an information society, the importance of a display device is further highlighted as a visual information transmission medium. As the display device, a liquid crystal display (LCD), a plasma display panel (PDP), an organic light emitting display (OLED), a field effect display (FED), and an electrophoretic display (EPD) are widely used.

20

[0004] The display device operates by receiving an electrical signal from an external source, and may include a touch screen to sense a touch event occurring on a display panel displaying an image.

[0005] The display device includes various electrode patterns activated by the electrical signal. Areas in which the electrode patterns are activated display information or respond to the touch event.

25

SUMMARY

5 [0006] The present disclosure provides a display device capable of preventing occurrence of a crack in an insulating layer included in a touch sensing unit.

[0007] The present disclosure also provides a display device capable of preventing the touch sensing unit from shorting.

10 [0008] Embodiments of the present disclosure provide a display device including a display panel, and a touch sensing unit on the display panel, the touch sensing unit including a first conductive pattern on the display panel, an insulating layer covering the first conductive pattern, and a second conductive pattern on the insulating layer, partially crossing the first conductive pattern, and having a thickness that is greater than a thickness of the first conductive pattern.

15 [0009] The first conductive pattern and the insulating layer may be directly on a thin film encapsulation layer of the display panel, and the insulating layer may include a first part on the first conductive pattern, and spaced from the thin film encapsulation layer, a second part contacting with the thin film encapsulation layer, and a third part connecting the first part and the second part.

20 [0010] The thickness of the first conductive pattern may be less than a thickness of the insulating layer.

[0011] The thickness of the first conductive pattern may be equal to or greater than about 1800 angstroms, and equal to or less than about 2100 angstroms, and the thickness of the second conductive pattern may be equal to or greater than about 2700 angstroms, and equal to or less than about 3500 angstroms.

25 [0012] The first conductive pattern may include a first conductive layer on the display panel, a second conductive layer on the first conductive layer, and a third conductive layer on the second conductive layer, the second conductive layer having an electrical resistivity that is less than an electrical resistivity of the first and third

conductive layers, and having a thickness that is greater than a thickness of the first conductive layer and a thickness of the third conductive layer.

5 **[0013]** The thickness of the third conductive layer may be greater than the thickness of the first conductive layer.

[0014] The thickness of the third conductive layer may be within a range from about one and a half times to about three times the thickness of the first conductive layer.

10 **[0015]** The thickness of the first conductive layer may be in a range from about 50 angstroms to about 200 angstroms, the thickness of the second conductive layer may be in a range from about 1000 angstroms to about 1800 angstroms, and the thickness of the third conductive layer may be in a range from about 250 angstroms to about 350 angstroms.

15 **[0016]** Each of the first conductive layer and the third conductive layer may include titanium (Ti), and the second conductive layer may include aluminum (Al).

20 **[0017]** The second conductive pattern may include a fourth conductive layer on the insulating layer, a fifth conductive layer on the fourth conductive layer, and a sixth conductive layer on the fifth conductive layer, the fifth conductive layer having an electrical resistivity that is less than an electrical resistivity of the fourth and sixth conductive layers, and having a thickness that is greater than a thickness of the fourth conductive layer and a thickness of the sixth conductive layer.

[0018] The thickness of the second conductive layer may be less than the thickness of the fifth conductive layer.

25 **[0019]** The thickness of the first conductive layer may be less than the thickness of the fourth conductive layer.

[0020] The thickness of the fourth conductive layer may be in a range from about 250 angstroms to about 350 angstroms, the thickness of the fifth conductive layer may be in a range from about 2200 angstroms to about 2800 angstroms, and the thickness

of the sixth conductive layer may be in a range from about 250 angstroms to about 350 angstroms.

5 **[0021]** Each of the fourth conductive layer and the sixth conductive layer may include titanium (Ti), and the fifth conductive layer may include aluminum (Al).

[0022] The second conductive pattern may include first connection parts, first touch sensor parts connected to each other by the first connection parts, and second touch sensor parts spaced from the first touch sensor parts.

10 **[0023]** The first conductive pattern may include second connection parts connecting the second touch sensor parts, and crossing the first connection parts.

[0024] The first conductive pattern may include second connection parts connecting the second touch sensor parts, each of the first touch sensor parts and the second touch sensor parts may include a plurality of mesh lines defining a plurality of mesh holes, and the second connection parts may cross the mesh lines of the first touch sensor parts and the mesh lines of the second touch sensor parts.

[0025] The second connection parts might not cross the first connection parts.

[0026] The first conductive pattern may include second connection parts connecting the second touch sensor parts, the insulating layer may be provided with a contact hole defined therethrough, and the second connection parts may connect the second touch sensor parts through the contact hole.

[0027] The display panel may include a base layer, a circuit layer on the base layer, an organic light emitting device layer on the circuit layer, and a thin film encapsulation layer on the organic light emitting device layer.

25 **[0028]** According to the above, the occurrence of cracking of the insulating layer included in the touch sensing unit may be reduced, and consequently, the short defect of the touch sensing unit may be avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

5 [0029] The above and other aspects of the present disclosure will become readily apparent by reference to the following detailed description when considered in conjunction with the accompanying drawings, wherein:

[0030] FIG. 1A is a perspective view showing a display device in a first operation state according to an embodiment of the present disclosure;

10 [0031] FIG. 1B is a perspective view showing a display device in a second operation state according to an embodiment of the present disclosure;

[0032] FIG. 1C is a perspective view showing a display device in a third operation state according to an embodiment of the present disclosure;

[0033] FIG. 2 is a cross-sectional view showing a display device according to an embodiment of the present disclosure;

15 [0034] FIGS. 3A and 3B are perspective views showing a display device according to an embodiment of the present disclosure;

[0035] FIGS. 4A and 4B are perspective views showing a display device according to an embodiment of the present disclosure;

20 [0036] FIG. 5A is a plan view showing a display panel included in a display device according to an embodiment of the present disclosure;

[0037] FIG. 5B is a cross-sectional view showing a display module included in a display device according to an embodiment of the present disclosure;

[0038] FIG. 6A is an equivalent circuit diagram of a pixel included in a display device according to an embodiment of the present disclosure;

25 [0039] FIG. 6B is a cross-sectional view showing a portion of a display panel included in a display device according to an embodiment of the present disclosure;

[0040] FIG. 6C is a cross-sectional view showing a portion of a display panel included in a display device according to an embodiment of the present disclosure;

5 [0041] FIGS. 7A to 7C are cross-sectional views showing thin film encapsulation layers included in a display device according to an embodiment of the present disclosure;

[0042] FIG. 8A is a cross-sectional view showing a touch sensing unit included in a display device according to an embodiment of the present disclosure;

[0043] FIGS. 8B to 8E are plan views showing a touch sensing unit included in a display device according to an embodiment of the present disclosure;

10 [0044] FIG. 8F is a partially enlarged view showing an area A1 of FIG. 8B;

[0045] FIG. 9 is a partially enlarged view showing an area A2 of FIG. 8B;

[0046] FIGS. 10A and 10B are cross-sectional views taken along the line I-I' of FIG. 9;

15 [0047] FIG. 11 is a cross-sectional view showing a touch sensing unit included in a conventional display device;

[0048] FIGS. 12A to 12D are plan views showing a touch sensing unit included in a display device according to an embodiment of the present disclosure;

[0049] FIGS. 13A to 13C are partially enlarged views showing an area A3 of FIG. 12A;

20 [0050] FIG. 14 is a cross-sectional view taken along the line II-II' of FIG. 13C;

[0051] FIG. 15 is a cross-sectional view showing a portion of a touch sensing unit included in a display device according to an embodiment of the present disclosure; and

[0052] FIG. 16 is a cross-sectional view showing a touch sensing unit included in a display device according to an embodiment of the present disclosure.

25

DETAILED DESCRIPTION

[0053] Features of the inventive concept and methods of accomplishing the same may be understood more readily by reference to the following detailed description of embodiments and the accompanying drawings. Hereinafter, example embodiments

will be described in more detail with reference to the accompanying drawings, in which like reference numbers refer to like elements throughout. The present invention,
 5 however, may be embodied in various different forms, and should not be construed as being limited to only the illustrated embodiments herein. Rather, these embodiments are provided as examples so that this disclosure will be thorough and complete, and will fully convey the aspects and features of the present invention to those skilled in the art. Accordingly, processes, elements, and techniques that are not necessary to those
 10 having ordinary skill in the art for a complete understanding of the aspects and features of the present invention may not be described. Unless otherwise noted, like reference numerals denote like elements throughout the attached drawings and the written description, and thus, descriptions thereof will not be repeated. In the drawings, the relative sizes of elements, layers, and regions may be exaggerated for clarity.

15 **[0054]** It will be understood that, although the terms “first,” “second,” “third,” etc., may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms are used to distinguish one element, component, region, layer or section from another element, component, region, layer or section.
 20 Thus, a first element, component, region, layer or section described below could be termed a second element, component, region, layer or section, without departing from the spirit and scope of the present invention.

[0055] Spatially relative terms, such as “beneath,” “below,” “lower,” “under,” “above,” “upper,” and the like, may be used herein for ease of explanation to describe one
 25 element or feature’s relationship to another element(s) or feature(s) as illustrated in the figures. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or in operation, in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as “below” or “beneath” or “under” other elements or features

would then be oriented "above" the other elements or features. Thus, the example terms "below" and "under" can encompass both an orientation of above and below.

5 The device may be otherwise oriented (e.g., rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein should be interpreted accordingly.

[0056] It will be understood that when an element, layer, region, or component is referred to as being "on," "connected to," or "coupled to" another element, layer, region, or component, it can be directly on, connected to, or coupled to the other element, layer, region, or component, or one or more intervening elements, layers, regions, or components may be present. In addition, it will also be understood that when an element or layer is referred to as being "between" two elements or layers, it can be the only element or layer between the two elements or layers, or one or more intervening elements or layers may also be present.

[0057] In the following examples, the x-axis, the y-axis and the z-axis are not limited to three axes of a rectangular coordinate system, and may be interpreted in a broader sense. For example, the x-axis, the y-axis, and the z-axis may be perpendicular to one another, or may represent different directions that are not perpendicular to one another.

[0058] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present invention. As used herein, the singular forms "a" and "an" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises," "comprising," "includes," and "including," when used in this specification, specify the presence of the stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. As used herein, the term "and/or" includes any and all combinations of one or

more of the associated listed items. Expressions such as “at least one of,” when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.

[0059] As used herein, the term "substantially," "about," and similar terms are used as terms of approximation and not as terms of degree, and are intended to account for the inherent deviations in measured or calculated values that would be recognized by those of ordinary skill in the art. Further, the use of “may” when describing embodiments of the present invention refers to “one or more embodiments of the present invention.” As used herein, the terms "use," "using," and "used" may be considered synonymous with the terms "utilize," "utilizing," and "utilized," respectively. Also, the term “exemplary” is intended to refer to an example or illustration.

[0060] When a certain embodiment may be implemented differently, a specific process order may be performed differently from the described order. For example, two consecutively described processes may be performed substantially at the same time or performed in an order opposite to the described order.

[0061] The electronic or electric devices and/or any other relevant devices or components according to embodiments of the present invention described herein may be implemented utilizing any suitable hardware, firmware (e.g. an application-specific integrated circuit), software, or a combination of software, firmware, and hardware. For example, the various components of these devices may be formed on one integrated circuit (IC) chip or on separate IC chips. Further, the various components of these devices may be implemented on a flexible printed circuit film, a tape carrier package (TCP), a printed circuit board (PCB), or formed on one substrate. Further, the various components of these devices may be a process or thread, running on one or more processors, in one or more computing devices, executing computer program instructions and interacting with other system components for performing the various functionalities described herein. The computer program instructions are stored in a

memory which may be implemented in a computing device using a standard memory device, such as, for example, a random access memory (RAM). The computer
 5 program instructions may also be stored in other non-transitory computer readable media such as, for example, a CD-ROM, flash drive, or the like. Also, a person of skill in the art should recognize that the functionality of various computing devices may be combined or integrated into a single computing device, or the functionality of a particular computing device may be distributed across one or more other computing
 10 devices without departing from the spirit and scope of the embodiments of the present invention.

[0062] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the present invention belongs. It will be further understood that
 15 terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and/or the present specification, and should not be interpreted in an idealized or overly formal sense, unless expressly so defined herein.

[0063] Hereinafter, the present invention will be explained in detail with reference to
 20 the accompanying drawings.

[0064] FIG. 1A is a perspective view showing a display device DD in a first operation state according to an embodiment of the present disclosure. FIG. 1B is a perspective view showing the display device DD in a second operation state according to an embodiment of the present disclosure. FIG. 1C is a perspective view showing
 25 the display device DD in a third operation state according to an embodiment of the present disclosure.

[0065] Referring to FIG. 1A, a display surface IS, in which an image IM is displayed in a first operation state of the display device DD, is substantially parallel to a surface or plane defined by a first direction axis DR1 and a second direction axis DR2. A

direction that is normal to the display surface IS (i.e., a thickness direction of the display device DD), indicates a third direction DR3. A front surface (or an "upper surface") is distinguished from a rear surface (or a "lower surface") by the third direction axis DR3. However, the first to third direction axes DR1 to DR3 are relative terms to each other, and thus the first to third direction axes DR1 to DR3 may be changed to any other directions. Hereinafter, first to third directions correspond to directions respectively indicated by the first to third direction axes DR1 to DR3, and thus the first to third directions are assigned with the same reference numerals as those of the first to third direction axes DR1 to DR3.

[0066] FIGS. 1A to 1C show a foldable display device as a representative example of the flexible display device DD, but it should not be limited there to or thereby. For example, the flexible display device DD may be a rollable display device, a bendable display device, or a flat rigid display device, for example. The flexible display device DD according to the present embodiment may be applied to a large-sized electronic item, such as a television set, a monitor, etc., and may be applied to a small and medium-sized electronic item, such as a mobile phone, a tablet, a car navigation unit, a game unit, a smart watch, etc.

[0067] Referring to FIG. 1A, the display surface IS of the flexible display device DD may include a plurality of areas. The flexible display device DD includes a display area DD-DA in which the image IM is displayed, and a non-display area DD-NDA located next to the display area DD-DA. The image IM is not displayed in the non-display area DD-NDA. FIG. 1A shows an image of a vase as the image IM. As an example, the display area DD-DA has a substantially quadrangular shape, and the non-display area DD-NDA surrounds the display area DD-DA, but they should not be limited thereto or thereby. That is, the shape of the display area DD-DA and the shape of the non-display area DD-NDA may be designed relative to each other.

[0068] Referring to FIGS. 1A to 1C, the display device DD is divided into a plurality of areas in accordance with the operation state thereof. The display device DD includes a bending area BA that may be bent with respect to a bending axis BX, a first non-bending area NBA1 that is not bent, and a second non-bending area NBA2 that is not bent. As shown in FIG. 1B, the display device DD may be inwardly bent such that the display surface IS of the first non-bending area NBA1 faces the display surface IS of the second non-bending area NBA2. As shown in FIG. 1C, the display device DD may be outwardly bent to allow the display surface IS to be exposed.

[0069] FIGS. 1A to 1C show only one bending area BA, but the number of the bending area BA is not limited to one. For instance, in the present embodiment, the display device DD may include a plurality of bending areas BA. In some embodiments, the display device DD may be configured to repeatedly perform only the operation modes shown in FIGS. 1A and 1B, although the present invention is not limited thereto or thereby. That is, the bending area BA may be defined to correspond to the user's operation performed on the display device DD. For instance, different from FIGS. 1B and 1C, the bending area BA may be defined to be substantially parallel to the first direction axis DR1 or may be defined in a diagonal direction. The bending area BA may have an area determined depending on a radius of curvature while not being fixed.

[0070] FIG. 2 is a cross-sectional view showing a display device DD according to an embodiment of the present disclosure. FIG. 2 shows the cross-section defined by the second and third directions DR2 and DR3.

[0071] Referring to FIG. 2, the display device DD includes a protective film PM, a display module DM, an optical member LM, a window WM, a first adhesive member AM1, a second adhesive member AM2, and a third adhesive member AM3. The display module DM is located between the protective film PM and the optical member LM. The optical member LM is located between the display module DM and the

window WM. The first adhesive member AM1 couples the display module DM and the protective film PM. The second adhesive member AM2 couples the display module
 5 DM and the optical member LM. The third adhesive member AM3 couples the optical member LM and the window WM. If suitable, at least one of the first, second, and third adhesive members AM1, AM2, and AM3 may be omitted.

[0072] The protective film PM protects the display module DM. The protective film PM includes a first outer surface OS-L exposed to the outside and an adhesive surface
 10 adhered to the first adhesive member AM1. The protective film PM prevents external moisture from entering the display module DM and absorbs external impacts.

[0073] The protective film PM may include a plastic film as a base substrate. The plastic film may include one or more of polyethersulfone (PES), polyacrylate, polyetherimide (PEI), polyethylenenaphthalate (PEN), polyethyleneterephthalate
 15 (PET), polyphenylene sulfide (PPS), polyarylate, polyimide (PI), polycarbonate (PC), poly(arylene ethersulfone), and a mixture thereof.

[0074] The material of the protective film PM may include a mixed material of an organic material and an inorganic material without being limited to plastic resins. The protective film PM may include a porous organic layer and an inorganic material filled
 20 in pores of the organic layer. The protective film PM may further include a functional layer formed in the plastic film. The functional layer may include a resin layer, and may be formed by a coating method. In other embodiments, the protective film PM may be omitted.

[0075] The window WM protects the display module DM from the external impacts and provides an input surface to the user. The window WM provides a second outer
 25 surface OS-U exposed to the outside, and an adhesive surface adhered to the third adhesive member AM3. The display surface IS shown in FIGS. 1A to 1C may be the second outer surface OS-U.

5 **[0076]** The window WM may include a plastic film. The window WM may have a multi-layer structure, which may be of a glass substrate, a plastic film, or a plastic substrate. The window WM may further include a bezel pattern. The multi-layer structure of the window WM may be formed through consecutive processes or an adhesive process using an adhesive.

10 **[0077]** The optical member LM reduces a reflectance of an external light. The optical member LM may include at least a polarizing film, and may further include a retardation film. In other embodiments, the optical member LM may be omitted.

15 **[0078]** The display module DM includes a display panel DP and a touch sensing unit TS. The touch sensing unit TS is directly located on the display panel DP. In the following descriptions, the expression "a first component is directly located on a second component" means that the first and second components are formed through consecutive processes without being attached to each other by using a separate adhesive layer. According to other embodiments, other layers (e.g., an adhesive layer, a substrate, etc.) may be interposed between the display panel DP and the touch sensing unit TS.

20 **[0079]** Hereinafter, an organic light emitting display panel DP will be described as the display panel DP, but the display panel DP should not be limited to the organic light emitting display panel DP. The display panel DP may be a liquid crystal display panel, a plasma display panel, an electrophoretic display panel, a microelectromechanical system (MEMS) display panel, or an electrowetting display panel.

25 **[0080]** The organic light emitting display panel DP generates the image IM (refer to FIG. 1) corresponding to image data input thereto. The organic light emitting display panel DP includes a first display panel surface BS1-L, and a second display panel surface BS1-U facing the first display panel surface BS1-L in the thickness direction DR3.

5 [0081] The touch sensing unit TS obtains coordinate information of an external input. The touch sensing unit TS senses the external input in an electrostatic capacitive manner.

10 [0082] The display module DM according to other embodiments may further include an anti-reflection layer. The anti-reflection layer may include a stack structure of a color filter or a conductive layer/an insulating layer/a conductive layer. The anti-reflection layer absorbs or polarizes external light to reduce reflectance of the external light. The anti-reflection layer may be used to substitute the function of the optical member LM.

15 [0083] Each of the first, second, and third adhesive members AM1, AM2, and AM3 may be, but are not limited to, an organic adhesive layer, such as an optically clear adhesive film (OCA), an optically clear resin (OCR), or a pressure sensitive adhesive film (PSA). The organic adhesive layer may include, for example, a polyurethane-based adhesive material, a polyacryl-based adhesive material, a polyester-based adhesive material, a poly epoxy-based adhesive material, or a polyvinyl acetate-based adhesive material.

20 [0084] The display device DD may further include a frame structure for supporting the functional layers to maintain the states shown in FIGS. 1A, 1B, and 1C. The frame structure may have a joint structure or a hinge structure.

25 [0085] FIGS. 3A and 3B are perspective views showing a display device DD-1 according to an embodiment of the present disclosure. FIG. 3A shows the display device DD-1 in an unfolded state, and FIG. 3B shows the display device DD-1 in a bent state.

[0086] The display device DD-1 includes one bending area BA and one non-bending area NBA. The non-display area DD-NDA of the display device DD-1 is bent, however, the bending area area of the display device DD-1 may be changed in other embodiments.

[0087] Different from the display device DD shown in FIGS. 1A to 1C, the display device DD-1 may be fixed in one state while being operated. The display device DD-1 may be operated in the bent state as shown in FIG. 3B. The display device DD-1 may be fixed to a frame while being bent, and the frame may be coupled to a housing of an electronic device.

[0088] The display device DD-1 according to the present embodiment may have substantially the same cross-sectional structure as that shown in FIG. 2. However, the non-bending area NBA and the bending area BA may have different stack structures from each other. The non-bending area NBA may have substantially the same cross-sectional structure as that shown in FIG. 2, and the bending area BA may have a cross-sectional structure different from that shown in FIG. 2. For example, the optical member LM and the window WM may be omitted from the bending area BA. That is, the optical member LM and the window WM may be located only in the non-bending area NBA. The second and third adhesive members AM2 and AM3 may be omitted from the bending area BA.

[0089] FIG. 4A is a perspective view showing a display device DD-2 according to an embodiment of the present disclosure.

[0090] Referring to FIG. 4A, the display device DD-2 includes a non-bending area (or a "plan surface area") NBA in which a main image is displayed to a front direction, and a bending area (or a "side surface area") BA in which a sub-image is displayed to a side direction. The sub-image may include an icon for providing information. In the present embodiment, the terms of "non-bending area NBA and bending area BA" used herein define the display device DD-2 configured to include plural areas with different shapes from each other.

[0091] The bending area BA bent from the non-bending area NBA displays the sub-image to a fourth direction axis DR4 crossing the first direction axis DR1, the second direction axis DR2, and the third direction axis DR3. However, the first to fourth

direction axes DR1 to DR4 are relative terms to each other, and thus the first to fourth direction axes DR1 to DR4 may be changed to any other directions.

5 **[0092]** FIG. 4B is a perspective view showing a display device DD-3 according to an embodiment of the present disclosure.

[0093] Referring to FIG. 4B, the display device DD-3 includes a non-bending area NBA in which a main image is displayed to a front direction, and includes first and second bending areas BA1 and BA2 in which a sub-image is displayed to a side
10 direction. The first bending area BA1 and the second bending area BA2 are respectively bent from opposite sides of the non-bending area NBA.

[0094] FIG. 5A is a plan view showing an organic light emitting display panel DP included in a display device according to an embodiment of the present disclosure, and FIG. 5B is a cross-sectional view showing a display module DM included in a display
15 device according to an embodiment of the present disclosure.

[0095] Referring to FIG. 5A, the organic light emitting display panel DP includes a display area DA and a non-display area NDA when viewed in a plan view. The display area DA and the non-display area NDA of the organic light emitting display panel DP respectively correspond to the display area DD-DA and the non-display area DD-NDA
20 of the display device DD (refer to FIG. 1A). The display area DA and the non-display area NDA of the organic light emitting display panel DP are not required to be identical to the display area DD-DA and the non-display area DD-NDA of the display device DD of FIG. 1A, and the display area DA and the non-display area NDA of the organic light emitting display panel DP may be changed in accordance with the structure and design
25 of the organic light emitting display panel DP.

[0096] The organic light emitting display panel DP includes a plurality of pixels PX. An area in which the pixels PX are arranged is referred to as the display area DA. In the present embodiment, the non-display area NDA is defined along an edge of the display area DA.

[0097] The organic light emitting display panel DP includes gate lines GL, data lines DL, light emitting lines EL, a control signal line SL-D, an initialization voltage line SL-Vint, a voltage line SL-VDD, and a pad part PD.

[0098] Each of the gate lines GL is connected to corresponding pixels of the pixels PX, and each of the data lines DL is connected to corresponding pixels of the pixels PX. Each of the light emitting lines EL is arranged to be substantially parallel to a corresponding gate line of the gate lines GL. The control signal line SL-D applies a control signal to a gate driving circuit GDC. The initialization voltage line SL-Vint applies an initialization voltage to the pixels PX. The voltage line SL-VDD is connected to the pixels PX to apply a first voltage to the pixels PX. The voltage lines SL-VDD includes a plurality of lines extending in the first direction DR1, and a plurality of lines extending in the second direction DR2.

[0099] The gate driving circuit GDC is located at one side portion of the non-display area NDA, and is connected to the gate lines GL and the light emitting lines EL. Some of the gate lines GL, the data lines DL, the light emitting lines EL, the control signal line SL-D, the initialization voltage line SL-Vint, and the voltage line SL-VDD are located on the same layer, and the others of the gate lines GL, the data lines DL, the light emitting lines EL, the control signal line SL-D, the initialization voltage line SL-Vint, and the voltage line SL-VDD are located on different layers.

[00100] The pad part PD is connected to an end of the data lines DL, the control signal line SL-D, the initialization voltage line SL-Vint, and the voltage line SL-VDD. As shown in FIG. 5B, the organic light emitting display panel DP includes a base layer/base substrate SUB, a circuit layer DP-CL located on the base layer SUB, an organic light emitting device layer DP-OLED located on the circuit layer DP-CL, and a thin film encapsulation layer TFE located on the organic light emitting device layer DP-OLED.

5 **[00101]** The base layer SUB includes at least one plastic film. The base layer SUB may be a flexible substrate, and may include a plastic substrate, a glass substrate, a metal substrate, or an organic/inorganic-mixed material substrate. The plastic substrate includes at least one of an acryl-based resin, a methacryl-based resin, polyisoprene-based resin, a vinyl-based resin, an epoxy-based resin, a urethane-based resin, a cellulose-based resin, a siloxane-based resin, a polyimide-based resin, a polyamide-based resin, and a perylene-based resin.

10 **[00102]** The circuit layer DP-CL includes a plurality of insulating layers, a plurality of conductive layers, and a semiconductor layer. The conductive layers of the circuit layer DP-CL may form signal lines or a control circuit of the pixel.

[00103] The organic light emitting device layer DP-OLED may include organic light emitting diodes.

15 **[00104]** The thin film encapsulation layer TFE encapsulates the organic light emitting device layer DP-OLED. The thin film encapsulation layer TFE includes an inorganic layer and an organic layer. The thin film encapsulation layer TFE may include at least two inorganic layers and an organic layer located between them. The inorganic layers protect the organic light emitting device layer DP-OLED from moisture and oxygen, and
20 the organic layer protects the organic light emitting device layer DP-OLED from foreign substance such as dust. The inorganic layer may include, for example, at least one of a silicon nitride layer, a silicon oxynitride layer, and a silicon oxide layer. The organic layer may include an acryl-based organic material, but it should not be limited thereto or thereby. According to the present embodiment, the touch sensing unit TS may
25 provide a uniform sensitivity by adjusting a thickness of the organic layer.

[00105] The touch sensing unit TS is directly located on the thin film encapsulation layer TFE, but is not limited thereto or thereby. An inorganic layer may be located on the thin film encapsulation layer TFE, and the touch sensing unit TS may be located on the inorganic layer. The inorganic layer may be a buffer layer. The inorganic layer

may include at least one of a silicon nitride layer, a silicon oxy-nitride layer, and a silicon oxide layer, but the inorganic layer should not be limited thereto or thereby. In addition, the inorganic layer may be included in the thin film encapsulation layer TFE without being provided as a separate element.

[00106] The touch sensing unit TS includes touch sensors and touch signal lines. The sensors and the touch signal lines may have a single-layer structure or a multi-layer structure.

10 **[00107]** The touch sensors and the touch signal lines may include indium tin oxide (ITO), indium zinc oxide (IZO), zinc oxide (ZnO), indium tin zinc oxide (ITZO), PEDOT, a metal nano-wire, and a graphene. The touch sensors and the touch signal lines may include a metal layer such as, for example, molybdenum, silver, titanium, copper, aluminum, or an alloy thereof. The touch sensors and the touch signal lines may have the same layer structure or different layer structures. The touch sensor layer TS will be described in detail later.

[00108] FIG. 6A is an equivalent circuit diagram of a pixel PX included in a display device according to an embodiment of the present disclosure.

[00109] FIG. 6A shows an i-th pixel PX_i connected to a k-th data line DL_k among the data lines DL.

20 **[00110]** The i-th pixel PX_i includes an organic light emitting diode OLED and a pixel driving circuit controlling the organic light emitting diode OLED. The pixel driving circuit includes seven thin film transistors T1 to T7 and one storage capacitor C_{st}. In the present embodiment, the pixel driving circuit includes seven transistors T1 to T7 and one storage capacitor C_{st}, but in other embodiments, the j-th pixel PX_j may include only a first transistor (or a "driving transistor") T1, a second transistor (or a "switching transistor") T2, and the storage capacitor C_{st} as the driving circuit to drive the organic light emitting diode OLED, and the pixel driving circuit may have various configurations.

5 **[00111]** The driving transistor controls a driving current applied to the organic light emitting diode OLED. An output electrode of the second transistor T2 is electrically connected to the organic light emitting diode OLED. The output electrode of the second transistor T2 directly makes contact with an anode of the organic light emitting diode OLED or is connected to the anode of the organic light emitting diode OLED via another transistor, e.g., a sixth transistor T6.

10 **[00112]** Control electrodes of respective control transistors receive respective control signals. The control signals applied to the i-th pixel PX_i include an (i-1)th gate signal Si-1, an i-th gate signal Si, an (i+1)th gate signal Si+1, a data signal D_k, and an i-th light emitting control signal Ei. In the present embodiment, the control transistors includes the first transistor T1 and third to seventh transistors T3 to T7.

15 **[00113]** The first transistor T1 includes an input electrode connected to the k-th data line DL_k, a control electrode connected to an i-th gate line GL_i, and an output electrode connected to the output electrode of the second transistor T2. The first transistor T1 is turned on by the gate signal Si (hereinafter, referred to as the "i-th gate signal") applied to the i-th gate line GL_i to provide the data signal D_k applied to the k-th data line DL_k to the storage capacitor C_{st}.

20 **[00114]** FIG. 6B is a cross-sectional view showing a portion of a display panel included in a display device according to an embodiment of the present disclosure. FIG. 6C is a cross-sectional view showing a portion of a display panel included in a display device according to an embodiment of the present disclosure. In detail, FIG. 6B shows the cross-section of the portion corresponding to the first transistor T1 of the equivalent circuit shown in FIG. 6A, and FIG. 6C shows the cross-section of the portion
25 corresponding to the second transistor T2, the sixth transistor T6, and the organic light emitting diode OLED of the equivalent circuit shown in FIG. 6A.

[00115] Referring to FIGS. 6B and 6C, the first transistor T1, the second transistor T2, and the sixth transistor T6 are located on the base layer SUB. The first, second,

and sixth transistors T1, T2, and T6 have the same structure as each other, and thus the first transistor T1 will be described in detail, and repeated detail of the second and sixth transistors T2 and T6 will be omitted.

5 **[00116]** An upper surface of the base layer SUB is defined by the first direction DR1 and the second direction DR2. The first transistor T1 includes a first input electrode DE1, a first output electrode SE1, a first control electrode GE1, and a first oxide semiconductor pattern OSP1.

10 **[00117]** A buffer layer BFL is located on the base layer SUB. The buffer layer BFL improves a coupling force between the base layer SUB and the conductive patterns or the semiconductor patterns. The buffer layer BFL includes an inorganic layer. In other embodiments, a barrier layer may be further located on the base layer SUB to prevent foreign substances from entering. The buffer layer BFL and the barrier layer may be
15 selectively used or omitted.

[00118] The base layer SUB may include a plastic substrate, a glass substrate, or a metal substrate. The plastic substrate includes at least one of an acryl-based resin, a methacryl-based resin, polyisoprene-based resin, a vinyl-based resin, an epoxy-based resin, a urethane-based resin, a cellulose-based resin, a siloxane-based resin, a
20 polyimide-based resin, a polyamide-based resin, and a perylene-based resin.

[00119] The first oxide semiconductor pattern OSP1 is located on the buffer layer BFL. The first oxide semiconductor pattern OSP1 includes indium tin oxide (ITO), indium gallium zinc oxide (IGZO), zinc oxide (ZnO), or indium zinc oxide (IZO).

[00120] A first insulating layer 10 is located on the buffer layer BFL to cover the first
25 oxide semiconductor pattern OSP1.

[00121] The first control electrode GE1 is located on the first insulating layer 10, and a second insulating layer 20 is located on the first insulating layer 10 to cover the first control electrode GE1. The second insulating layer 20 provides a flat upper

surface/planarized surface. The second insulating layer 20 includes an organic material and/or an inorganic material.

5 **[00122]** The first insulating layer 10 and the second insulating layer 20 include an inorganic material, which may include at least one of aluminum oxide, titanium oxide, silicon oxide, silicon oxynitride, zirconium oxide, and hafnium oxide

[00123] Meanwhile, a first contact hole CH1 and a second contact hole CH2 are defined through the first and second insulating layers 10 and 20 to respectively expose
10 a first area and a second area of the first oxide semiconductor pattern OSP1. Each of the first and second contact holes CH1 and CH2 penetrates through the first and second insulating layers 10 and 20.

[00124] The first input electrode DE1 and the first output electrode SE1 are located on the second insulating layer 20. The first input electrode DE1 and the first output
15 electrode SE1 are respectively connected to the first area and the second area of the first oxide semiconductor pattern OSP1 through the first contact hole CH1 and the second contact hole CH2.

[00125] A third insulating layer 30 is located on the second insulating layer 20 to cover the first input electrode DE1 and the first output electrode SE1. The third
20 insulating layer 30 provides a flat upper surface. The third insulating layer 30 includes an organic material and/or an inorganic material. The third insulating layer 30 covers input electrodes and output electrodes.

[00126] FIG. 6C shows the sixth transistor T6 having substantially the same structure as the second transistor T2. However, the structure of the sixth transistor T6 may be
25 changed. The sixth transistor T6 includes an input electrode DE6 connected to the output electrode SE2 of the second transistor T2 on the second insulating layer 20.

[00127] The organic light emitting diode OLED and a pixel definition layer PDL are located on the third insulating layer 30. An anode AE is located on the third insulating layer 30. The anode AE is connected to a sixth output electrode SE6 of the sixth

transistor T6 through a seventh contact hole CH7 defined through the third insulating layer 30. The pixel definition layer PDL is provided with an opening OP defined therethrough. At least a portion of the anode AE is exposed through the opening OP of the pixel definition layer PDL.

[00128] The pixel PX is located in a pixel area of the organic light emitting display panel DP when viewed in a plan view. The pixel area includes a light emitting area PXA and a non-light emitting area NPXA next to the light emitting area PXA. The non-light emitting area NPXA is located to surround the light emitting area PXA. In the present embodiment, the light emitting area PXA is defined to correspond to the anode AE, but should not be limited thereto or thereby. The light emitting area PXA may be defined as an area in which a light is generated. The light emitting area PXA may be defined to correspond to a portion of the anode AE exposed through the opening OP.

[00129] A hole control layer HCL is commonly located in the light emitting area PXA and the non-light emitting area NPXA. Although not shown in figures, a common layer like the hole control layer HCL may be commonly formed in the plural pixels PX.

[00130] An organic light emitting layer EML is located on the hole control layer HCL. The organic light emitting layer EML is located only in an area corresponding to the opening OP. That is, the organic light emitting layer EML may be patterned into plural parts, and the parts may be respectively located in the pixels PX.

[00131] An electron control layer ECL is located on the organic light emitting layer EML. A cathode CE is located on the electron control layer ECL. The cathode CE is commonly located in the pixels PX.

[00132] The thin film encapsulation layer TFE is located on the cathode CE. The thin film encapsulation layer TFE is commonly located in the pixels PX. The thin film encapsulation layer TFE includes at least one inorganic layer and at least one organic layer. The thin film encapsulation layer TFE may include a plurality of inorganic layers and a plurality of organic layers alternately stacked with the inorganic layers.

[00133] In the present embodiment, the patterned organic light emitting layer EML is shown as a representative example, but the organic light emitting layer EML may be commonly located in the pixels PX. In this case, the organic light emitting layer EML may generate a white light. In addition, the organic light emitting layer EML may have a multi-layer structure.

[00134] In the present embodiment, the thin film encapsulation layer TFE directly covers the cathode CE. In the present embodiment, a capping layer may further cover the cathode CE, and the thin film encapsulation layer TFE may directly cover the capping layer.

[00135] FIGS. 7A to 7C are cross-sectional views showing thin film encapsulation layers included in a display device according to an embodiment of the present disclosure. Hereinafter, the thin film encapsulation layer will be described in detail with reference to FIGS. 7A to 7C.

[00136] Referring to FIG. 7A, a thin film encapsulation layer TFE1 includes n inorganic thin layers IOL1 to IOLn, and a first inorganic thin layer IOL1 among the n inorganic thin layers IOL1 to IOLn is located on the cathode CE (refer to FIG. 6C). In addition, the first inorganic thin layer IOL1 may be located to directly contact the cathode CE (refer to FIG. 6C). The first inorganic thin layer IOL1 may be referred to as a "lower inorganic thin layer," and the inorganic thin layers except for the first inorganic thin layer IOL1 among the n inorganic thin layers IOL1 to IOLn may be referred to as "upper inorganic thin layers."

[00137] The thin film encapsulation layer TFE1 includes n-1 organic thin layers OL1 to OLn-1, and the n-1 organic thin layers OL1 to OLn-1 are alternately arranged with the n inorganic thin layers IOL1 to IOLn. The n-1 organic thin layers OL1 to OLn-1 may have a thickness that is greater than that of the n inorganic thin layers IOL1 to IOLn.

[00138] Each of the n inorganic thin layers IOL1 to IOLn may have a single-layer structure containing one type of material, or may have a multi-layer structure containing

plural different types of material. Each of the n-1 organic thin layers OL1 to OLn-1 may be formed by depositing organic monomers. Each of the n-1 organic thin layers OL1 to OLn-1 may be formed by using an inkjet printing method or by coating a composition containing an acryl-based monomer. In the present embodiment, the thin film encapsulation layer TFE1 may further include an n-th organic thin layer.

[00139] Referring to FIGS. 7B and 7C, the inorganic thin layers included in each of the thin film encapsulation layers TFE2 and TFE3 may include the same inorganic material, or may include different inorganic materials from each other, and may have the same thickness or different thicknesses. The organic thin layers included in each of the thin film encapsulation layers TFE2 and TFE3 may include the same organic material, or may include different organic materials from each other, and may have the same thickness or different thicknesses.

[00140] As shown in FIG. 7B, the thin film encapsulation layer TFE2 includes the first inorganic thin layer IOL1, the first organic thin layer OL1, the second inorganic thin layer IOL2, the second organic thin layer OL2, and the third inorganic thin layer IOL3, which are sequentially stacked.

[00141] The first inorganic thin layer IOL1 may have a two-layer structure. A first sub-layer S1 and a second sub-layer S2 of the first inorganic thin layer IOL1 may have different inorganic materials.

[00142] As shown in FIG. 7C, the thin film encapsulation layer TFE3 includes a first inorganic thin layer IOL10, a first organic thin layer OL1, and a second inorganic thin layer IOL20, which are sequentially stacked. The first inorganic thin layer IOL10 may have a two-layer structure. A first sub-layer S10 and a second sub-layer S20 included in the first inorganic thin layer IOL10 may have different inorganic materials. The second inorganic thin layer IOL20 may have a two-layer structure. The second inorganic thin layer IOL20 may include a first sub-layer S100 and a second sub-layer S200, which are deposited in different environments. The first sub-layer S100 may be

deposited at lower power, and the second sub-layer S200 may be deposited at high power. The first and second sub-layers S100 and S200 may include the same
5 inorganic material.

[00143] FIG. 8A is a cross-sectional view showing a touch sensing unit included in a display device according to an embodiment of the present disclosure. FIGS. 8B to 8E are plan views showing a touch sensing unit included in a display device according to an embodiment of the present disclosure.

10 **[00144]** Referring to FIG. 8A, the touch sensing unit TS includes a first conductive pattern TS-CP1, a first insulating layer TS-IL1 (hereinafter, referred to as a "first touch insulating layer"), a second conductive pattern TS-CP2, and a second insulating layer TS-IL2 (hereinafter, referred to as a "second touch insulating layer"). The first conductive pattern TS-CP1 is directly located on the thin film encapsulation layer TFE,
15 but it should not be limited thereto or thereby. That is, another inorganic layer (e.g., a buffer layer) may be further located between the first conductive pattern TS-CP1 and the thin film encapsulation layer TFE.

[00145] If suitable, the second touch insulating layer TS-IL2 may be omitted. A portion of the second conductive pattern TS-CP2 crosses the first conductive pattern TS-CP1. The portion of the second conductive pattern TS-CP2 is insulated from the
20 first conductive pattern TS-CP1 while crossing the first conductive pattern TS-CP1, and the first touch insulating layer TS-IL1 is located between the first and second conductive patterns TS-CP1 and TS-CP2.

[00146] Each of the first conductive pattern TS-CP1 and the second conductive pattern TS-CP2 has a single-layer structure or a multi-layer structure of plural layers
25 stacked in the third direction DR3.

[00147] Each of the first touch insulating layer TS-IL1 and the second touch insulating layer TS-IL2 includes an inorganic material or an organic material. The inorganic material includes at least one of aluminum oxide, titanium oxide, silicon

oxide, silicon nitride, silicon oxynitride, zirconium oxide, and hafnium oxide. The organic material includes at least one of an acryl-based resin, a methacryl-based resin, 5 polyisoprene-based resin, a vinyl-based resin, an epoxy-based resin, a urethane-based resin, a cellulose-based resin, a siloxane-based resin, a polyimide-based resin, a polyamide-based resin, and a perylene-based resin.

[00148] The first touch insulating layer TS-IL1 should not be limited to a specific shape if the first touch insulating layer TS-IL1 insulates the first conductive pattern TS-CP1 and the second conductive pattern TS-CP2. The first touch insulating layer TS-IL1 entirely covers the thin film encapsulation layer TFE or includes a plurality of 10 insulating patterns. The insulating patterns are overlapped with first connection parts BR1 and second connection parts BR2 described later.

[00149] In the present embodiment, the two-layer type touch sensing unit has been described, but the touch sensing unit should not be limited to the two-layer type. A 15 single-layer type touch sensing unit includes a conductive layer and an insulating layer covering the conductive layer. The conductive layer includes touch sensors and touch signal lines connected to the touch sensors. The single-layer type touch sensing unit obtains coordinate information using a self-capacitance method.

[00150] Referring to FIG. 8B, the touch sensing unit TS includes first touch electrodes TE1 and second touch electrodes TE2. The first touch electrodes TE1 include the first connection parts BR1, first touch sensor parts SP1 connected by the first connection parts BR1, and first touch signal lines SL1 connected to the first touch sensor parts SP1. The second touch electrodes TE2 include the second connection 20 parts BR2, second touch sensor parts SP2 connected by the second connection parts BR2, and second touch signal lines SL2 connected to the second touch sensor parts SP2. In addition, connection electrodes TSD may be located between the first touch electrodes TE1 and the first touch signal lines SL1, and between the second touch electrodes TE2 and the second touch signal lines SL2 connected to the second touch 25

electrodes TE2. The connection electrodes TSD are connected to ends of the first and second touch electrodes TE1 and TE2 to transmit signals. According to another
5 embodiment, the connection electrodes TSD may be omitted.

[00151] The first touch sensor parts SP1 are arranged in the first direction DR1, and the second touch sensor parts SP2 are arranged in the second direction DR2. The first touch sensor parts SP1 are spaced apart from the second touch sensor parts SP2.

[00152] The first touch electrodes TE1 extend in the first direction DR1 and are
10 spaced apart from each other in the second direction DR2. The second touch electrodes TE2 extend in the second direction DR2 and are spaced apart from each other in the first direction DR1.

[00153] Each of the first connection parts BR1 connects two adjacent first touch sensor parts SP1 among the first touch sensor parts SP1. Each of the second
15 connection parts BR2 connects two adjacent second touch sensor parts SP2 among the second touch sensor parts SP2. In FIG. 8B, portions of the first and second connection parts BR1 and BR2 are represented by a bold dot to help description.

[00154] The touch sensing unit TS may further include touch pad parts TS-PD. Each of the first and second touch signal lines SL1 and SL2 may be connected to a
20 corresponding touch pad part of the touch pad parts TS-PD.

[00155] The first touch sensor parts SP1 are capacitively coupled to the second touch sensor parts SP2. When the touch sensing signals are applied to the first touch sensor parts SP1, capacitors are formed between the first touch sensor parts SP1 and the second touch sensor parts SP2.

25 **[00156]** Hereinafter, the touch sensing unit TS will be described in more detail with reference to FIGS. 8C to 8E.

[00157] Referring to FIG. 8C, the first conductive patterns TS-CP1 may include the second connection parts BR2. The second connection parts BR2 may be directly formed on the thin film encapsulation layer TFE by a patterning process. That is, the

first conductive patterns TS-CP1 may be directly located on the thin film encapsulation layer TFE of the organic light emitting display panel DP.

5 **[00158]** The first touch insulating layer TS-IL1 is located on the first conductive patterns TS-CP1. The first touch insulating layer TS-IL1 is directly located on the thin film encapsulation layer TFE of the organic light emitting display panel DP and covers the second connection parts BR2. As shown in FIG. 8D, a plurality of contact holes CH is defined through the first touch insulating layer TS-IL1 to partially expose the second
10 connection parts BR2. The contact holes CH are formed by a photolithography process. The second connection parts BR2 of the first conductive pattern TS-CP1 are electrically connected to the second touch sensor parts SP2 through the contact holes CH.

[00159] Referring to FIG. 8E, the second conductive patterns TS-CP2 are located on
15 the first touch insulating layer TS-IL1. The second conductive patterns TS-CP2 include the first connection parts BR1, the first touch sensor parts SP1 connected by the first connection parts BR1, and the second touch sensor parts SP2 spaced apart from the first touch sensor parts SP1. As described above, the second touch sensor parts SP2 are electrically connected to the second connection parts BR2 of the first conductive
20 pattern TS-CP1 through contact holes CH defined through the first touch insulating layer TS-IL1.

[00160] FIG. 8F is a partially enlarged view showing an area A1 of FIG. 8B. FIG. 9 is a partially enlarged view showing an area A2 of FIG. 8B.

[00161] Referring to FIGS. 8F and 9, each of the first touch sensor parts SP1 and the
25 second touch sensor parts SP2 may include a plurality of mesh lines ML to define a plurality of mesh holes MH. Each mesh line ML has a line width of a few micrometers, for example. Each of the first touch sensor part SP1 and the second touch sensor parts SP2 may have a mesh shape. Although not shown in detail, the first touch signal lines SL1 and the second touch signal lines SL2 may have the mesh shape. Each of

the first touch sensor parts SP1 and the second touch sensor parts SP2 is overlapped with the non-light emitting area NPXA.

5 **[00162]** When viewed in a plan view, the mesh holes MH have different sizes from each other. The mesh holes MH may respectively correspond to the light emitting areas PXA in a one-to-one correspondence, but they should not be limited thereto or thereby. That is, one mesh hole may correspond to two or more light emitting areas PXA, for example. The light emitting areas PXA may have different sizes from each
10 other when viewed in a plan view. Correspondingly, the mesh holes MH may have different sizes from each other when viewed in a plan view. For instance, the light emitting areas PXA may include a red light emitting area, a green light emitting area, and a blue light emitting area, and the light emitting areas PXA may have different sizes determined depending on their colors. However, the light emitting areas PXA
15 may have the same size as each other, and the mesh holes MH may have the same size as each other.

[00163] Referring to FIG. 9, the first connection parts BR1 may cross the second connection parts BR2. The first connection parts BR1 and the second connection parts BR2 are insulated from each other by the first touch insulating layer TS-IL1 located
20 between the first and second connection parts BR1 and BR2 while crossing each other. In FIG. 9, the first connection parts BR1 and the second connection parts BR2 are represented by bold lining to aid in description, but they should not be limited thereto or thereby. For instance, the first connection parts BR1 may not cross the second connection parts BR2, and this structure will be described in detail later.

25 **[00164]** As shown in FIG. 9, each of the first connection parts BR1 and the second connection parts BR2 may have the mesh shape. However, the second connection parts BR2 may not have the mesh shape in other embodiments.

[00165] FIGS. 10A and 10B are cross-sectional views taken along the line I-I' of FIG. 9.

[00166] Referring to FIGS. 10A and 10B, the first conductive pattern TS-CP1 has a thickness D1 that is smaller than a thickness D2 of the second conductive pattern TS-CP2. The first conductive pattern TS-CP1 shown in FIGS. 10A and 10B corresponds to the second connection part BR2. The thickness D1 of the first conductive pattern TS-CP1 may be smaller than a thickness D3 of the first touch insulating layer TS-IL1.

[00167] In the present description, the term "thickness" denotes an average value of the thickness, or general thickness, in a corresponding component.

10 **[00168]** As described above, the first conductive pattern TS-CP1 and the first touch insulating layer TS-IL1 may be directly located on the thin film encapsulation layer TFE of the organic light emitting display panel DP. The first touch insulating layer TS-IL1 has a structure in which a step difference exists. In detail, the first touch insulating layer TS-IL1 is located on the first conductive pattern TS-CP1 and includes a first part
15 IL-SUB1 spaced apart from the thin film encapsulation layer TFE, a second part IL-SUB2 making contact with the thin film encapsulation layer TFE, and a third part IL-SUB3 connecting the first part IL-SUB1 and the second part IL-SUB2. The first part IL-SUB1, the second part IL-SUB2, and the third part IL-SUB3 are integrally connected to each other.

20 **[00169]** The third part IL-SUB3 may have a rectangular shape when viewed in a cross section, but the shape of the third part IL-SUB3 should not be limited to the rectangular shape. That is, the third part IL-SUB3 may have a polygonal shape including an inclined surface when viewed in a cross section.

[00170] FIG. 11 is a cross-sectional view showing a touch sensing unit included in a
25 conventional display device 1000. In detail, the conventional display device 1000 shown in FIG. 11 includes a display panel 100 and a touch sensing unit 200 located on the display panel 100.

[00171] The touch sensing unit 200 of the conventional display device 1000 includes a first conductive pattern 210, an insulating layer 220 covering the first conductive

pattern 210, and a second conductive pattern 230 located on the insulating layer 220, and a thickness K1 of the first conductive pattern 210 is substantially equal to or
5 slightly different from a thickness K2 of the second conductive pattern 230. In more detail, the thickness K1 of the first conductive pattern 210, a thickness K3 of the insulating layer 220, and the thickness K2 of the second conductive pattern 230 are substantially equal to each other or slightly different from each other. A step difference occurs in the insulating layer 220 due to the first conductive pattern 210 covered by the
10 insulating layer 220, and a crack occurs at an area in which the step difference exists, as shown in the area B of FIG. 11. Due to the crack occurring in the insulating layer 220, the first conductive pattern 210 is electrically connected to a portion of the second conductive pattern 230 crossing the first conductive pattern 210, and as a result, a short (e.g., electrical short) defect of the touch sensing unit 200 is generated.

15 **[00172]** According to the display device DD of the present disclosure, the thickness D1 of the first conductive pattern TS-CP1 is smaller than that of the conventional first conductive pattern 210, and thus the step difference occurring in the first touch insulating layer TS-IL1 becomes small, thereby minimizing the occurrence of the crack in the insulating layer. To effectively achieve the effect, the thickness D1 of the first
20 conductive pattern TS-CP1 may be suitably less than the thickness D3 of the first touch insulating layer TS-IL1. The thickness D3 of the first touch insulating layer TS-IL1 and the thickness D2 of the second conductive pattern TS-CP2 are substantially equal to each other, or are slightly different from each other. That is, only the thickness D1 of the first conductive pattern TS-CP1 among the first conductive pattern TS-CP1, the first
25 touch insulating layer TS-IL1, and the second conductive pattern TS-CP2 is set to be relatively thin in the display device DD according to the present embodiment, and thus the first touch insulating layer TS-IL1 may be prevented from being cracked, or the crack of the first touch insulating layer TS-IL1 may be reduced or minimized.

5 **[00173]** For instance, the thickness D1 of the first conductive pattern TS-CP1 is equal to or greater than about 1800 angstroms, and equal to or less than about 2100 angstroms, and the thickness D2 of the second conductive pattern TS-CP2 is equal to or greater than about 2700 angstroms and equal to or less than about 3500 angstroms. As an example, the thickness D1 of the first conductive pattern TS-CP1 may be about 1950 angstroms, and the thickness D2 of the second conductive pattern TS-CP2 may be about 3100 angstroms, but they should not be limited thereto or thereby.

10 **[00174]** In the present embodiment, the thickness D3 of the first touch insulating layer TS-IL1 is equal to or greater than about 2700 angstroms, and equal to or less than about 3500 angstroms. As an example, the thickness D3 of the first touch insulating layer TS-IL1 may be about 3100 angstroms, but it should not be limited thereto or thereby.

15 **[00175]** FIGS. 12A to 12D are plan views showing a touch sensing unit included in a display device according to other embodiments of the present disclosure. FIGS. 13A to 13C are partially enlarged views showing an area A3 of FIG. 12A. In detail, FIG. 13A shows second connection parts BR2 included in a first conductive pattern TS-CP1 in the area A3 of FIG. 12A, FIG. 13B shows a second conductive pattern TS-CP2 in the area A3, and FIG. 13C shows a stack structure of the first conductive pattern TS-CP1 and the second conductive pattern TS-CP2.

20 **[00176]** As described above, the first connection parts BR1 might not cross the second connection parts BR2. Referring to FIGS. 12A to 12D, the second connection parts BR2 do not cross the first connection parts BR1, and the second connection parts BR2 cross the first touch sensor parts SP1 and the second touch sensor parts SP2. Referring to FIGS. 13A to 13C, the first touch sensor parts SP1 include the mesh lines ML defining the mesh holes MH as described above, and each of the second connection parts BR2 crosses a portion of the mesh lines ML of the first touch sensor parts SP1. The second touch sensor parts SP2 include the mesh lines ML defining the

mesh holes MH as described above, and each of the second connection parts BR2 crosses a portion of the mesh lines ML of the second touch sensor parts SP2. In this case, the second connection parts BR2 may not have the mesh shape.

5 **[00177]** The descriptions with reference to FIGS. 8B to 8E may be applied to the touch sensing unit shown in FIGS. 12A to 12D except for the descriptions of the second connection parts BR2, and thus repeated detailed descriptions of the touch sensing unit with reference to FIGS. 12A to 12D will be omitted except for the second connection parts BR2.

10 **[00178]** FIG. 14 is a cross-sectional view taken along the line II-II' of FIG. 13C. The descriptions with reference to FIGS. 10A and 10B may be applied to the touch sensing unit shown in FIG. 14, except that difference features between the structure in which the second conductive pattern TS-CP2 shown in FIGS. 10A and 10B corresponds to the first connection parts BR1 among components of the second conductive pattern TS-CP2 and the structure in which the second conductive pattern TS-CP2 shown in FIG. 14 corresponds to the first touch sensor parts SP1 among components of the second conductive pattern TS-CP2, and thus repeated detailed descriptions of the touch sensing unit with reference to FIG. 14 will be omitted, although different features will be described.

15 **[00179]** FIG. 15 is a cross-sectional view showing a portion of a touch sensing unit included in a display device according to an embodiment of the present disclosure.

20 **[00180]** The first conductive pattern TS-CP1 may have a single-layer structure or a multi-layer structure. As shown in FIG. 15, the first conductive pattern TS-CP1 may have a triple-layer structure. The first conductive pattern TS-CP1 may include a first conductive layer CD1, a second conductive layer CD2, and a third conductive layer CD3. The first conductive layer CD1 is located on the thin film encapsulation layer TFE of the display panel DP, the second conductive layer CD2 is located on the first conductive layer CD1, and the third conductive layer CD3 is located on the second

conductive layer CD2. In this case, an entire thickness D1 of the first conductive pattern TS-CP1 corresponds to a sum of a thickness G1 of the first conductive layer CD1, a thickness G2 of the second conductive layer CD2, and a thickness G3 of the third conductive layer CD3.

[00181] The second conductive layer CD2 has an electrical resistivity smaller than that of each of the first conductive layer CD1 and the third conductive layer CD3. That is, the second conductive layer CD2 has a superior electrical conductivity when compared to that of each of the first conductive layer CD1 and the third conductive layer CD3. Each of the first, second, and third conductive layers CD1, CD2, and CD3 may include typical materials as long as the first, second, and third conductive layers CD1, CD2, and CD3 satisfy the above-mentioned relation. For instance, each of the first, second, and third conductive layers CD1, CD2, and CD3 may include silver, copper, aluminum, titanium, molybdenum, or an alloy thereof. As another example, each of the first and third conductive layers CD1 and CD3 may include titanium (Ti), and the second conductive layer CD2 may include aluminum (Al).

[00182] The thickness G2 of the second conductive layer CD2 may be greater than the thickness G1 of the first conductive layer CD1 and the thickness G3 of the third conductive layer CD3. The thickness G2 of the second conductive layer CD2 may be, for example, six times greater than the thickness G1 of the first conductive layer CD1. The thickness G2 of the second conductive layer CD2 may be, for example, four times greater than the thickness G3 of the third conductive layer CD3.

[00183] The thickness G3 of the third conductive layer CD3 may be greater than the thickness G1 of the first conductive layer CD1. The thickness G3 of the third conductive layer CD3 may be, for example, one and half times greater than the thickness G1 of the first conductive layer CD1. In other embodiments, the thickness G3 of the third conductive layer CD3 may be, for example, one and half times to three times greater than the thickness G1 of the first conductive layer CD1.

5 [00184] The second conductive layer CD2 is an essential component for the first conductive pattern CP1 to serve as a conductive pattern, and the first and third conductive layers CD1 and CD3 serve as a protective layer protecting the second conductive layer CD2 to obtain a process stability. In detail, the first conductive layer CD1 protects the second conductive layer CD2 from defects occurring under the touch sensing unit TS, and the third conductive layer CD3 prevents the second conductive layer CD2 from being damaged during an etching process.

10 [00185] As described above, because the first conductive layer CD1 and the third conductive layer CD3 have different purposes, the first conductive layer CD1 and the third conductive layer CD3 may suitably have different thicknesses. That is, because the third conductive layer CD3 may suitably have a predetermined thickness or more such that the second conductive layer CD2 is protected in the etching process, only the thickness G1 of the first conductive layer CD1 is controlled to be small, and thus the entire thickness D1 of the first conductive pattern CP1 may be smaller than the entire thickness D2 of the second conductive pattern CP2. However, the thickness G1 of the first conductive layer CD1 may still suitably have a predetermined thickness or more and, for example, the thickness G1 of the first conductive layer CD1 may be about 50 angstroms or more. In a case than the thickness G1 of the first conductive layer CD1 is less than about 50 angstroms, the first conductive layer CD1 might not serve as the protective layer protecting the second conductive layer CD2.

25 [00186] For instance, the thickness G1 of the first conductive layer CD1 is in a range from about 50 angstroms to about 200 angstroms, the thickness G2 of the second conductive layer CD2 is in a range from about 1000 angstroms to about 1800 angstroms, and the thickness G3 of the third conductive layer CD3 is in a range from about 250 angstroms to about 350 angstroms. In detail, the thickness G1 of the first conductive layer CD1 may be about 150 angstroms, the thickness G2 of the second conductive layer CD2 may be about 1500 angstroms, and the thickness G3 of the third

conductive layer CD3 may be about 300 angstroms. However, the thicknesses G1, G2, and G3 of the first, second, and third conductive layers CD1, CD2, and CD3 should not be limited thereto or thereby.

[00187] FIG. 16 is a cross-sectional view showing a touch sensing unit included in a display device according to an embodiment of the present disclosure.

[00188] Referring to FIG. 16, the second conductive pattern TS-CP2 may have a multi-layer structure as similar to the first conductive pattern TS-CP1, but it should not be limited thereto or thereby. The second conductive pattern TS-CP2 may have a single-layer structure if the second conductive pattern TS-CP2 is thicker than the first conductive pattern TS-CP1.

[00189] The second conductive pattern TS-CP2 may have a triple-layer structure. The second conductive pattern TS-CP2 may include a fourth conductive layer CD4, a fifth conductive layer CD5, and a sixth conductive layer CD6. The fourth conductive layer CD4 is located on the first touch insulating layer TS-IL1, the fifth conductive layer CD5 is located on the fourth conductive layer CD4, and the sixth conductive layer CD6 is located on the fifth conductive layer CD5. In this case, the entire thickness D2 of the second conductive pattern TS-CP2 corresponds to a sum of a thickness G4 of the fourth conductive layer CD4, a thickness G5 of the fifth conductive layer CD5, and a thickness G6 of the sixth conductive layer CD6.

[00190] The fifth conductive layer CD5 has an electrical resistivity smaller than that of each of the fourth conductive layer CD4 and the sixth conductive layer CD6. That is, the fifth conductive layer CD5 has a superior electrical conductivity when compared to that of each of the fourth conductive layer CD4 and the sixth conductive layer CD6. Each of the fourth, fifth, and sixth conductive layers CD4, CD5, and CD6 may include typical materials as long as the fourth, fifth, and sixth conductive layers CD4, CD5, and CD6 satisfy the above-mentioned relation. For instance, each of the fourth, fifth, and sixth conductive layers CD4, CD5, and CD6 may include silver, copper, aluminum,

titanium, molybdenum, or an alloy thereof. As another example, each of the fourth and sixth conductive layers CD4 and CD6 may include titanium (Ti), and the fifth conductive layer CD5 may include aluminum (Al).

[00191] The thickness G5 of the fifth conductive layer CD5 may be greater than the thickness G4 of the fourth conductive layer CD4 and the thickness G6 of the sixth conductive layer CD6. The thickness G5 of the fifth conductive layer CD5 may be, for example, four times greater than the thickness G4 of the fourth conductive layer CD4.

10 The thickness G5 of the fifth conductive layer CD5 may be, for example, four times greater than the thickness G6 of the sixth conductive layer CD6.

[00192] The fifth conductive layer CD5 is an essential component for the second conductive pattern TS-CP2 to serve as a conductive pattern, and the fourth and sixth conductive layers CD4 and CD6 serve as a protective layer protecting the fifth conductive layer CD5 to obtain a process stability. In detail, the fourth conductive layer CD4 protects the fifth conductive layer CD5 from defects occurring under the second conductive pattern CP2, and the sixth conductive layer CD6 prevents the fifth conductive layer CD5 from being damaged during an etching process.

[00193] The thickness G2 of the second conductive layer CD2 may be smaller than the thickness G5 of the fifth conductive layer CD5. That is, the entire thickness of the first conductive pattern TS-CP1 may become smaller than the second conductive pattern TS-CP2 by allowing the thickness G2 of the second conductive layer CD2 to be smaller than the thickness G5 of the fifth conductive layer CD5.

[00194] The thickness G1 of the first conductive layer CD1 may be smaller than the thickness G4 of the fourth conductive layer CD4. That is, the entire thickness of the first conductive pattern TS-CP1 may become smaller than the second conductive pattern TS-CP2 by allowing the thickness G1 of the first conductive layer CD1 to be smaller than the thickness G4 of the fourth conductive layer CD4 that is a lower protective layer of the second conductive pattern TS-CP2.

5 [00195] For instance, the thickness G4 of the fourth conductive layer CD4 is in a range from about 250 angstroms to about 350 angstroms, the thickness G5 of the fifth conductive layer CD5 is in a range from about 2200 angstroms to about 2800 angstroms, and the thickness G6 of the sixth conductive layer CD6 is in a range from about 250 angstroms to about 350 angstroms. In detail, the thickness G4 of the fourth conductive layer CD4 may be about 300 angstroms, the thickness G5 of the fifth conductive layer CD5 may be about 2500 angstroms, and the thickness G6 of the sixth conductive layer CD6 may be about 300 angstroms. However, the thicknesses G4, G5, and G6 of the fourth, fifth, and sixth conductive layers CD4, CD5, and CD6 should not be limited thereto or thereby.

10 [00196] The display device DD according to the embodiments of the present disclosure may reduce the occurrence of the crack in the insulating layer, e.g., the first touch insulating layer TS-IL1, included in the touch sensing unit TS. Consequently, the display device DD according to the embodiments of the present disclosure may reduce an electrical short defect of the touch sensing unit TS.

15 [00197] Although the embodiments of the present invention have been described, it is understood that the present invention should not be limited to these embodiments, but various changes and modifications can be made by one ordinary skilled in the art within the spirit and scope of the present invention as defined by the claims and their functional equivalents.

20

FIG. 1A

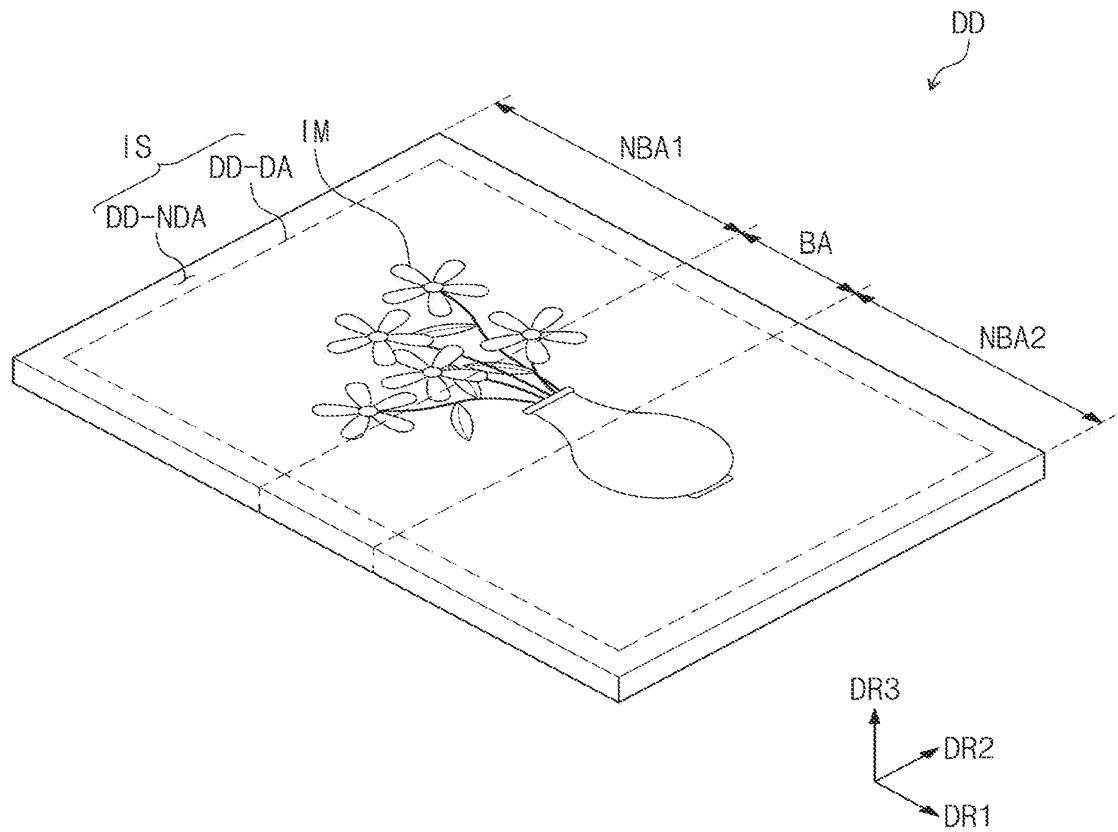


FIG. 1B

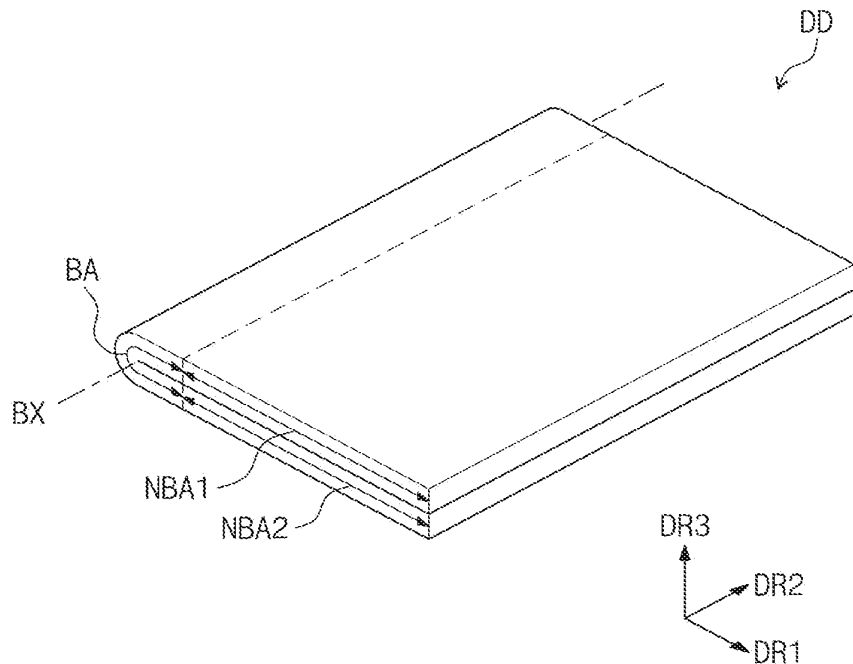


FIG. 1C

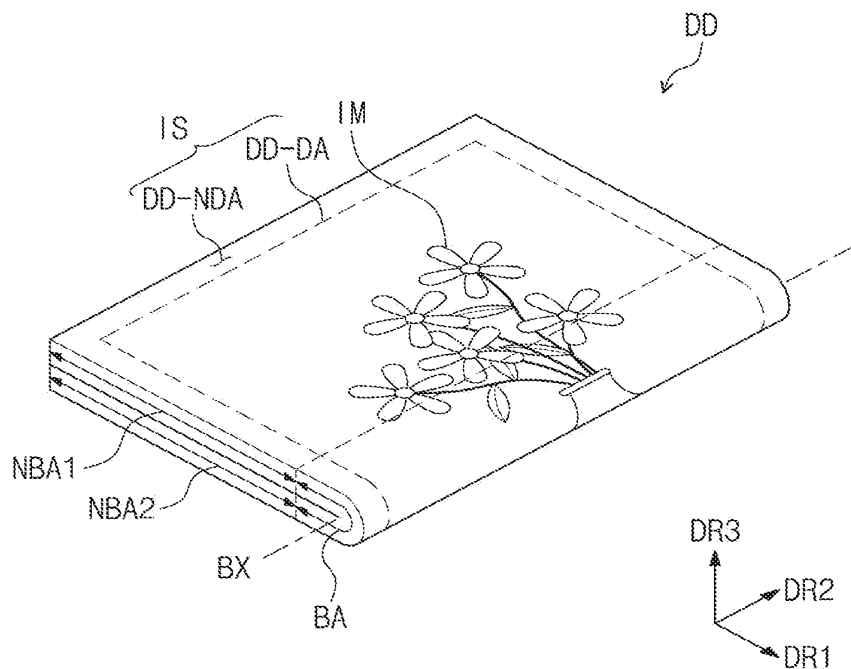


FIG. 2

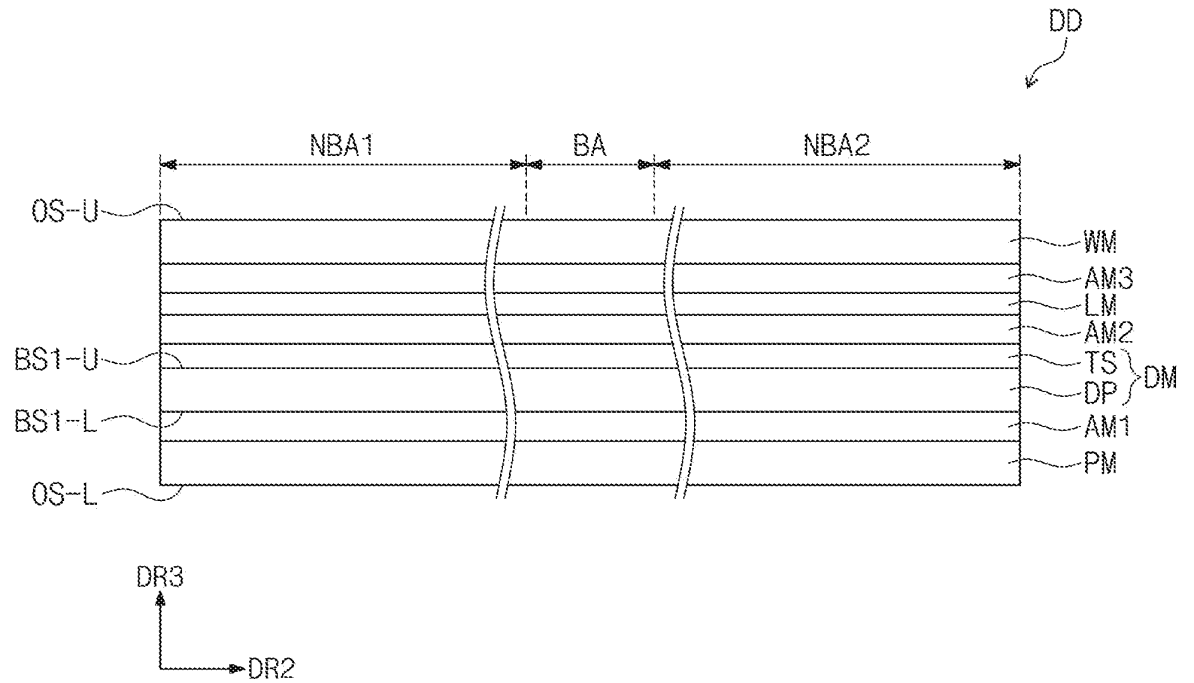


FIG. 3A

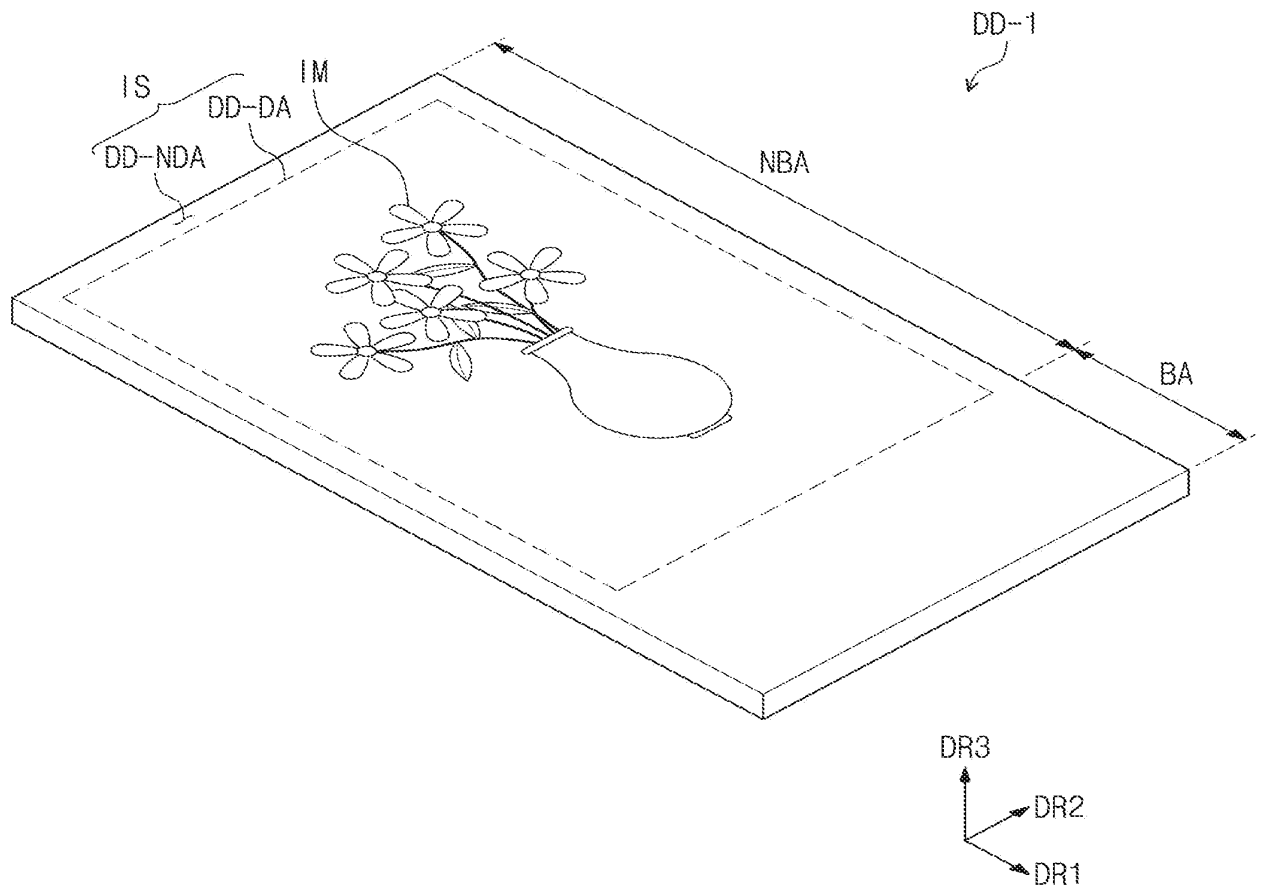


FIG. 3B

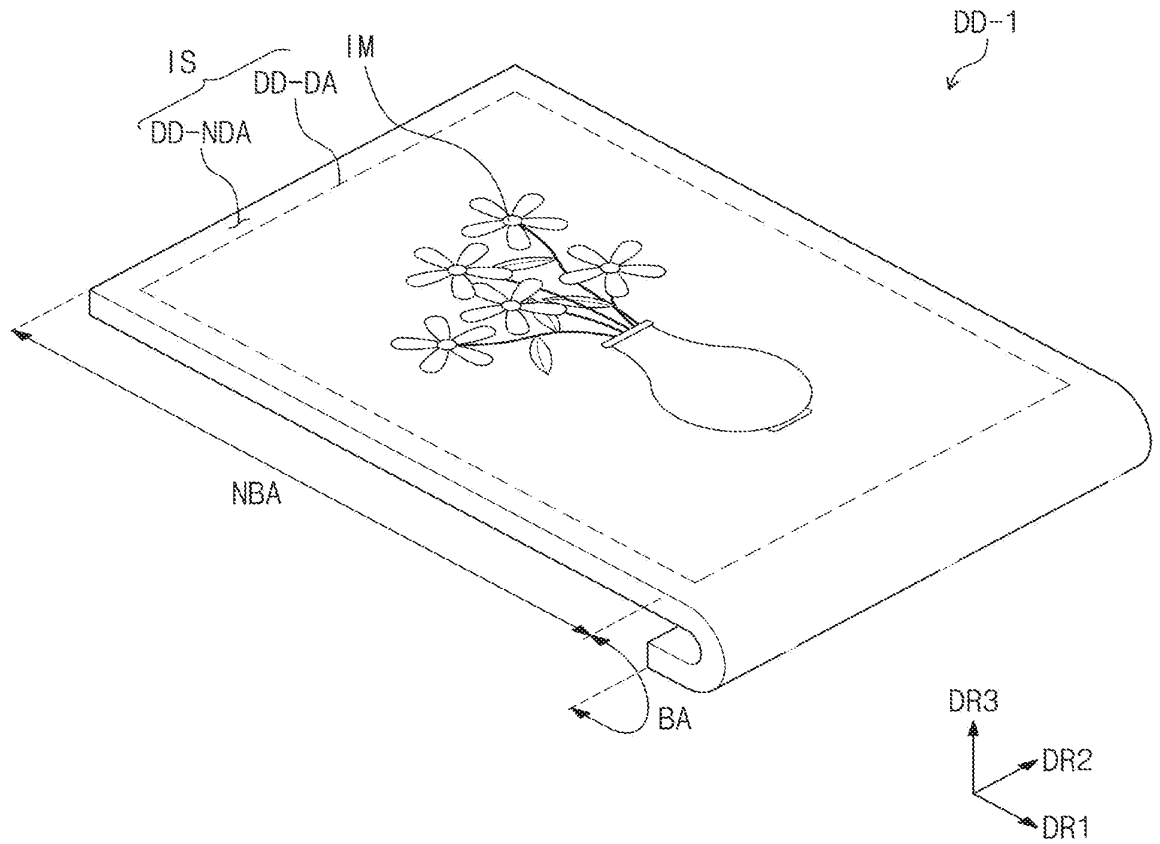


FIG. 4A

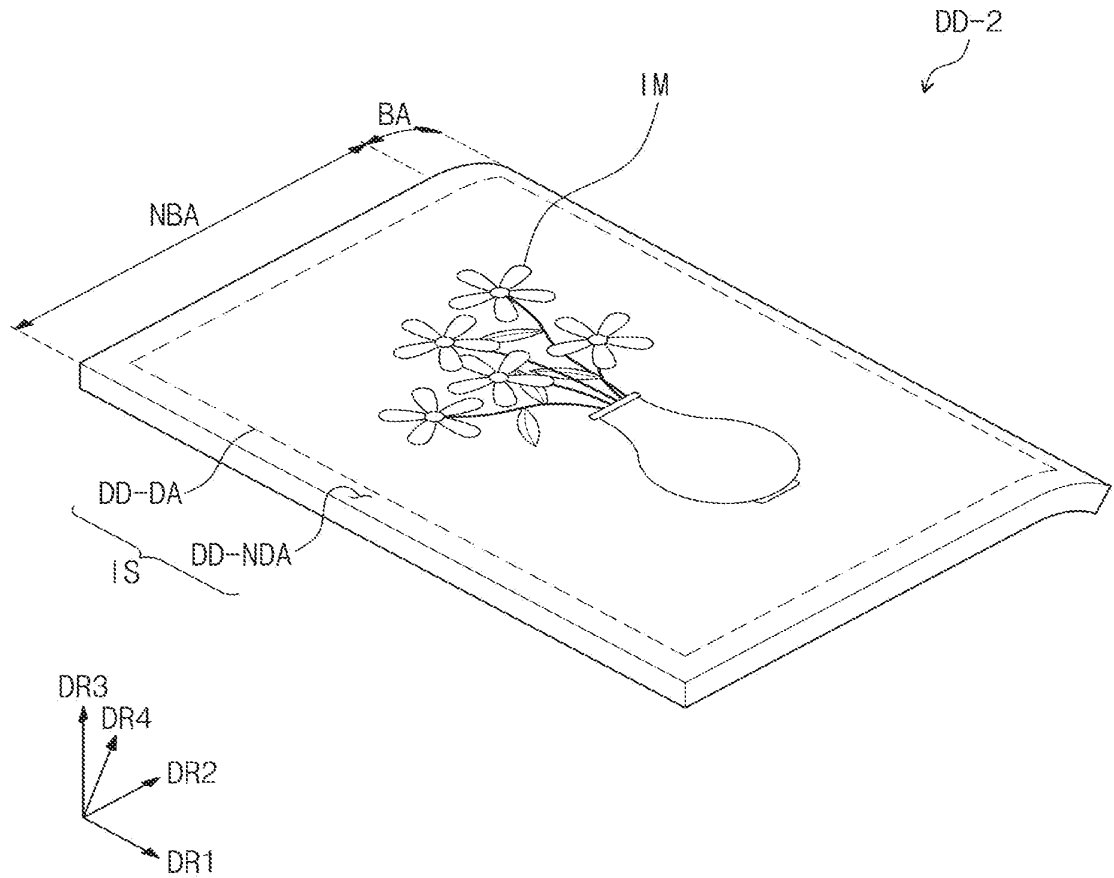


FIG. 4B

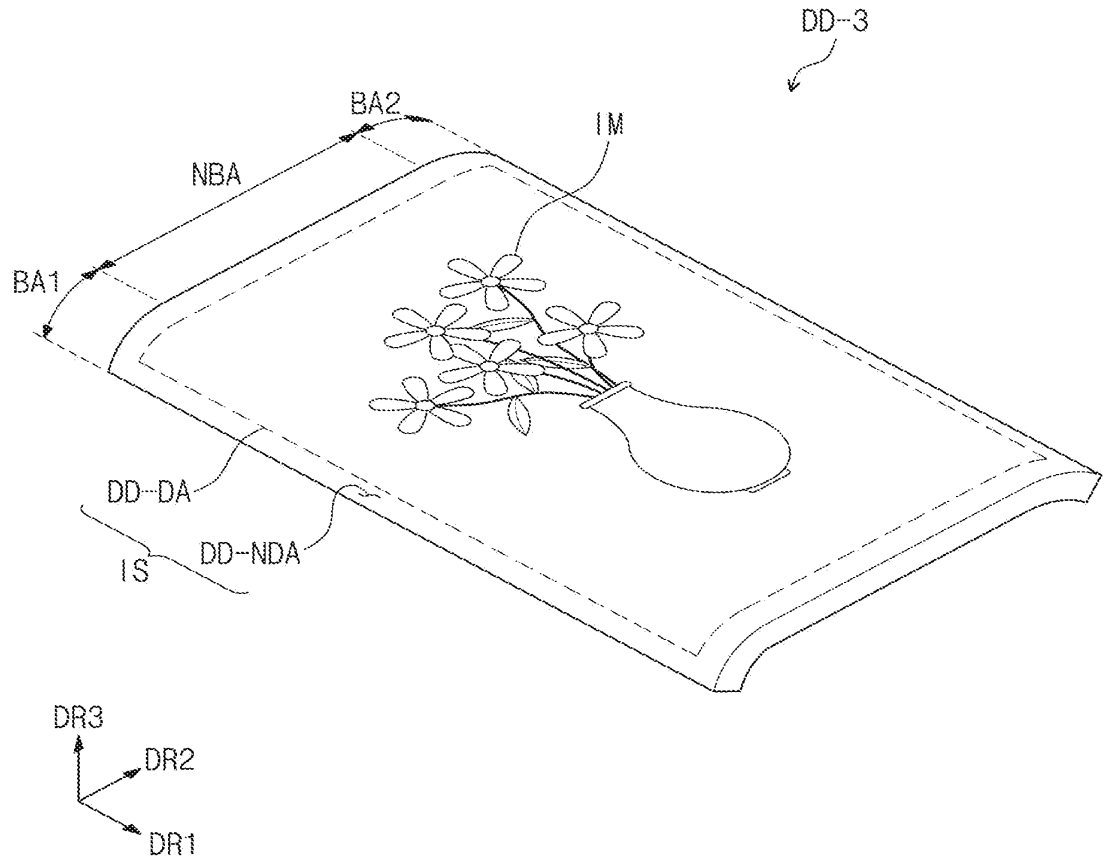


FIG. 5B

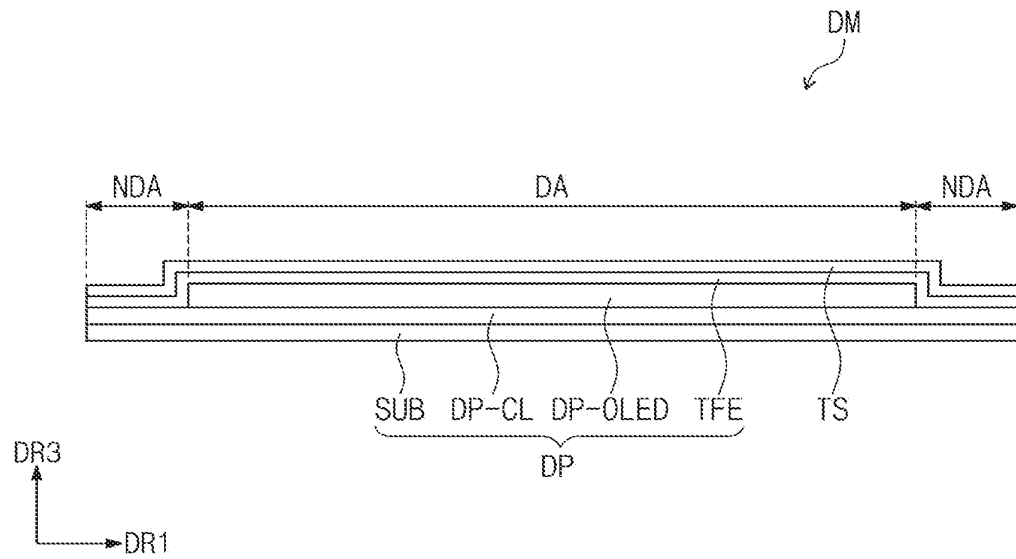


FIG. 6A

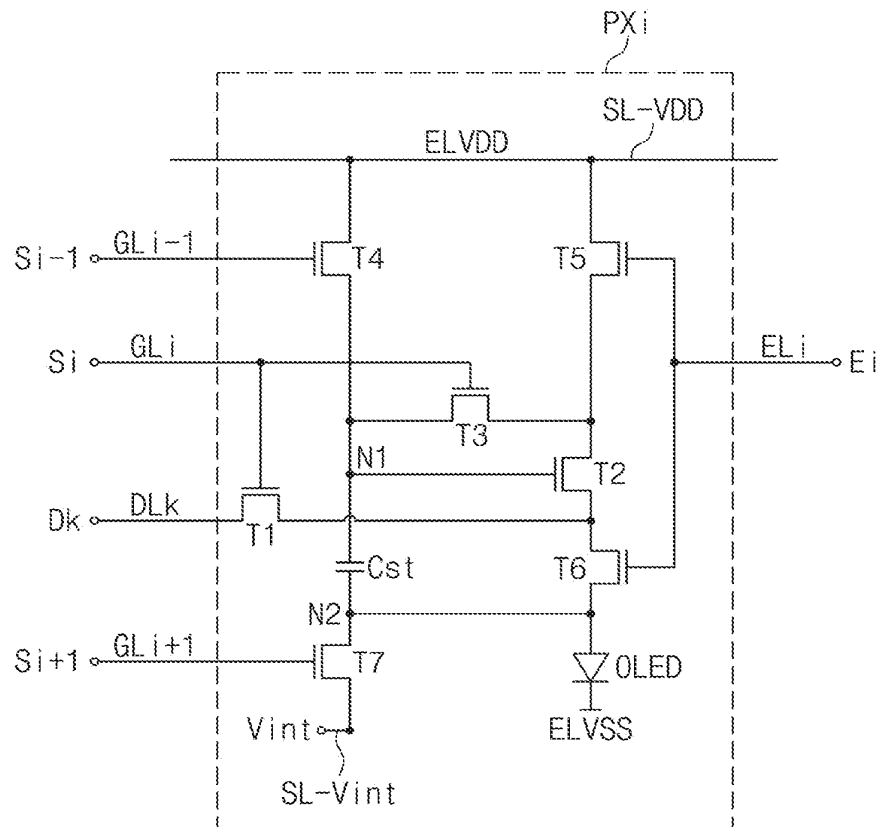


FIG. 6B

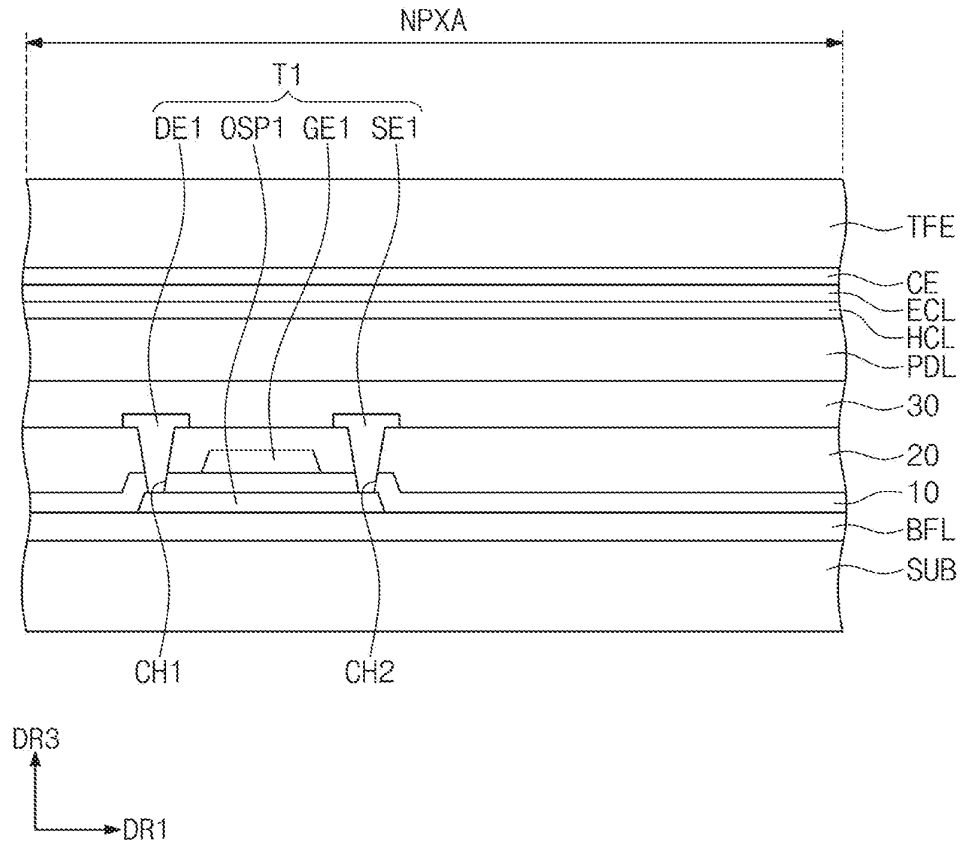


FIG. 6C

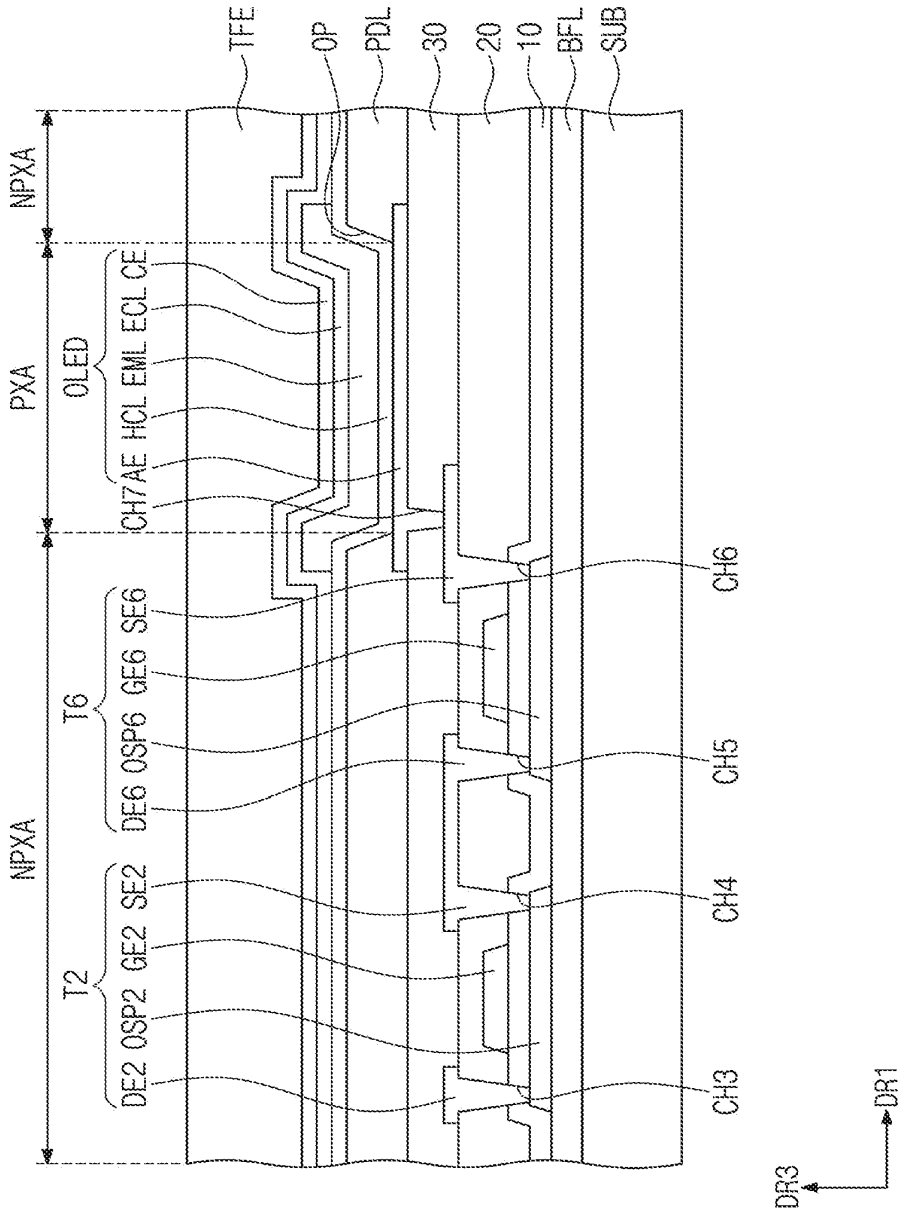


FIG. 7A

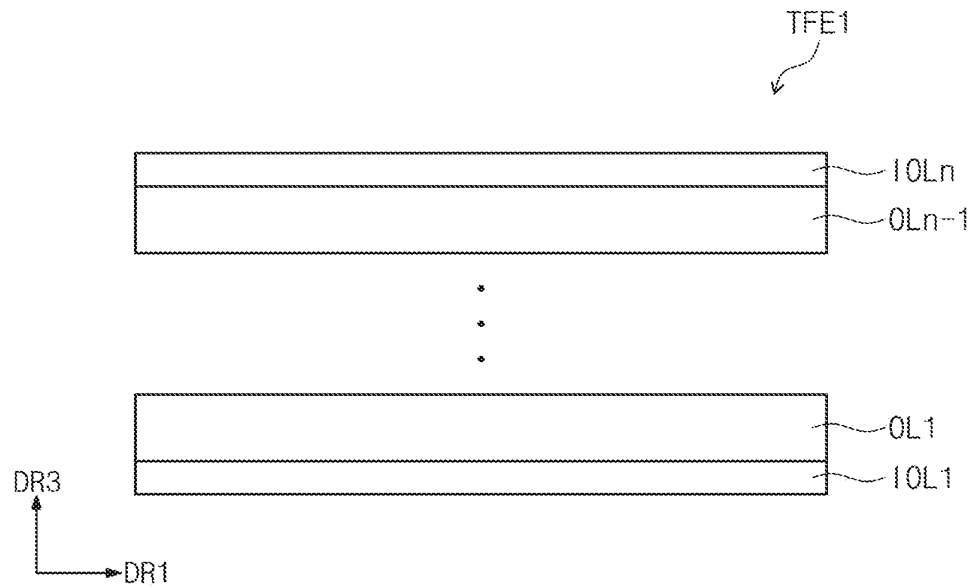


FIG. 7B

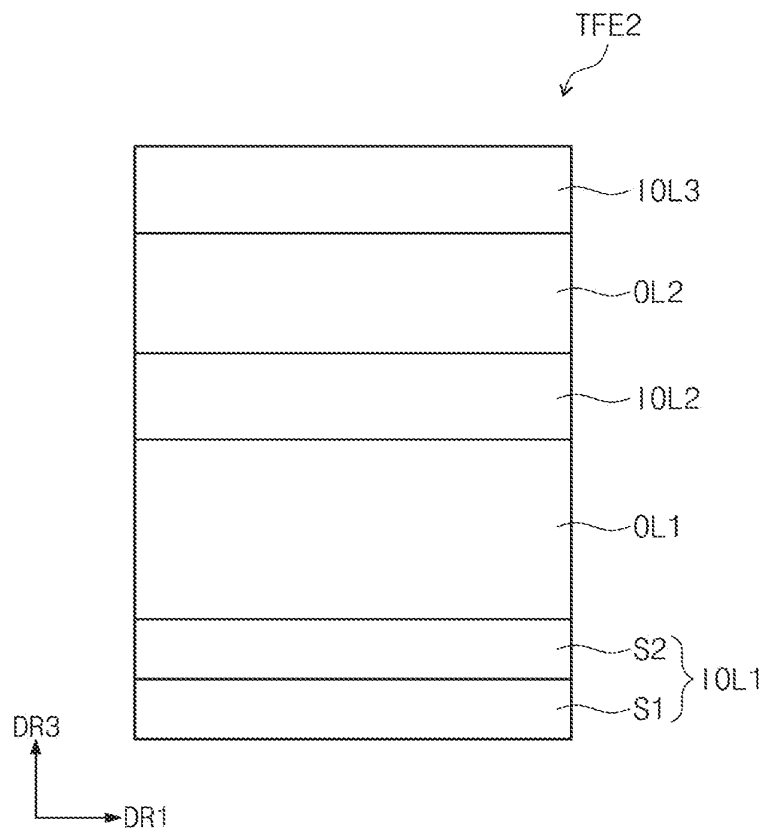


FIG. 7C

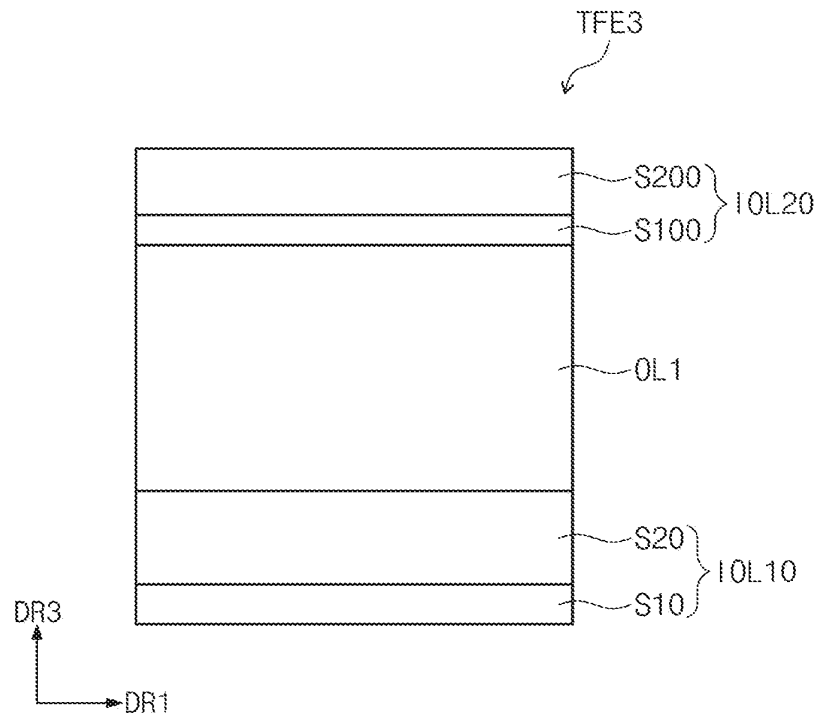


FIG. 8A

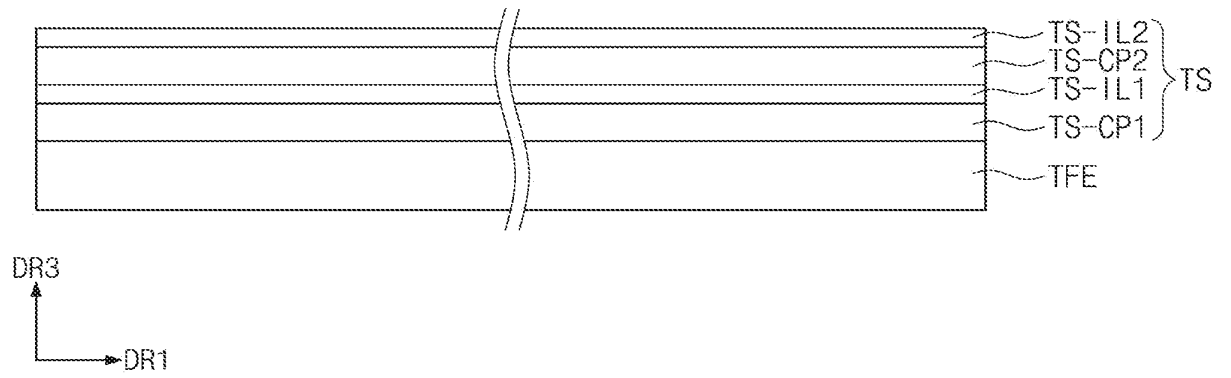


FIG. 8B

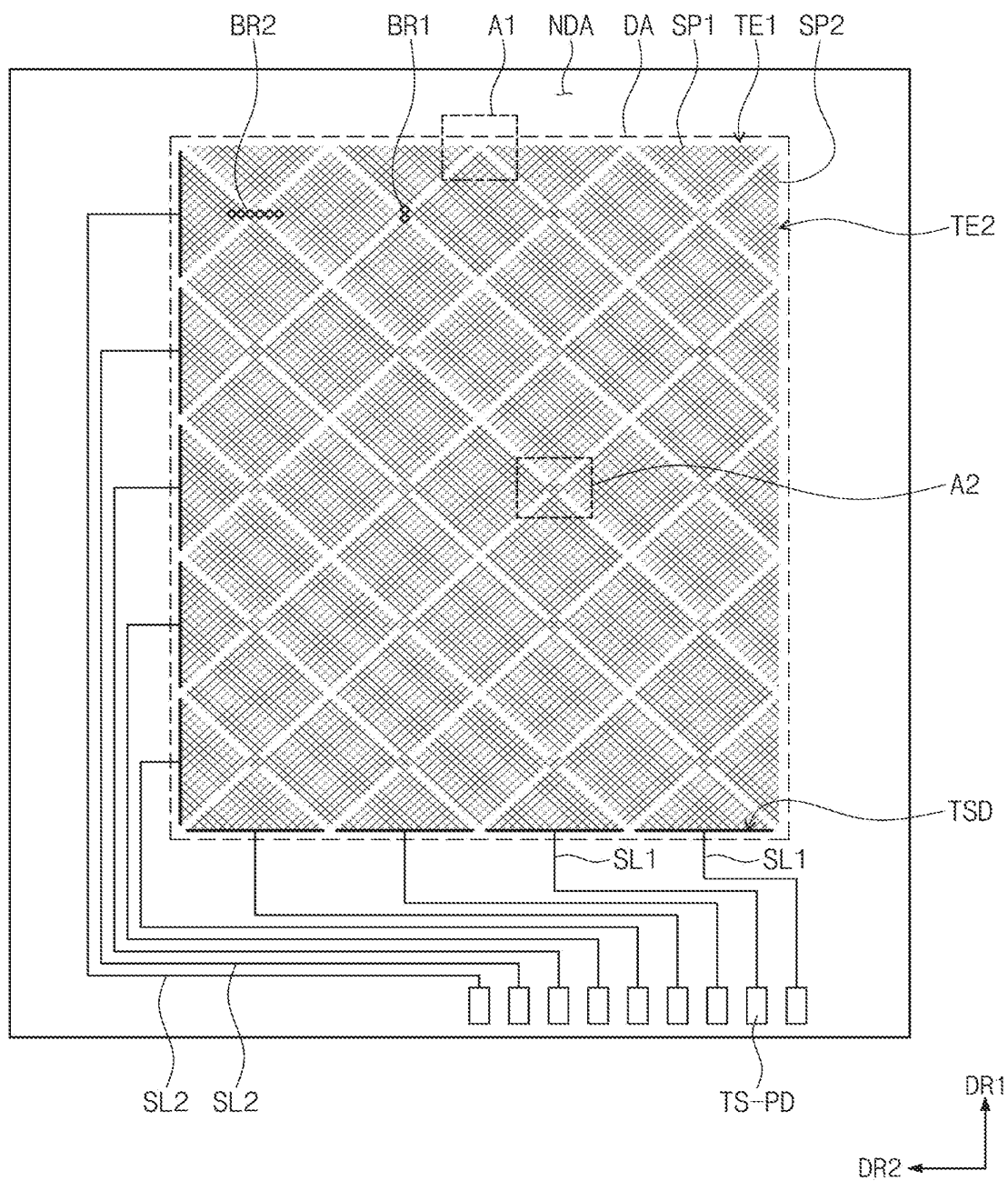


FIG. 8C

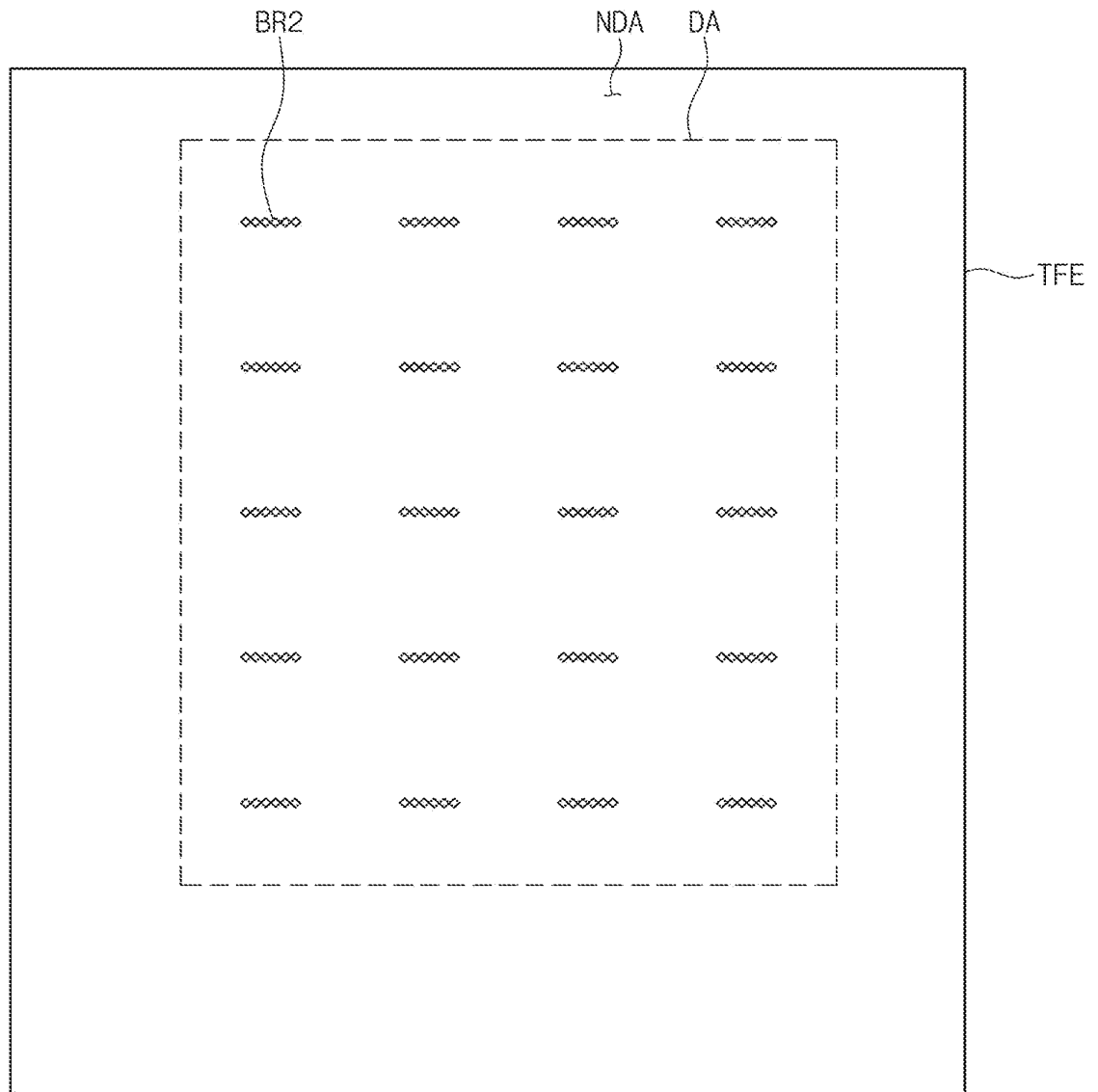


FIG. 8D

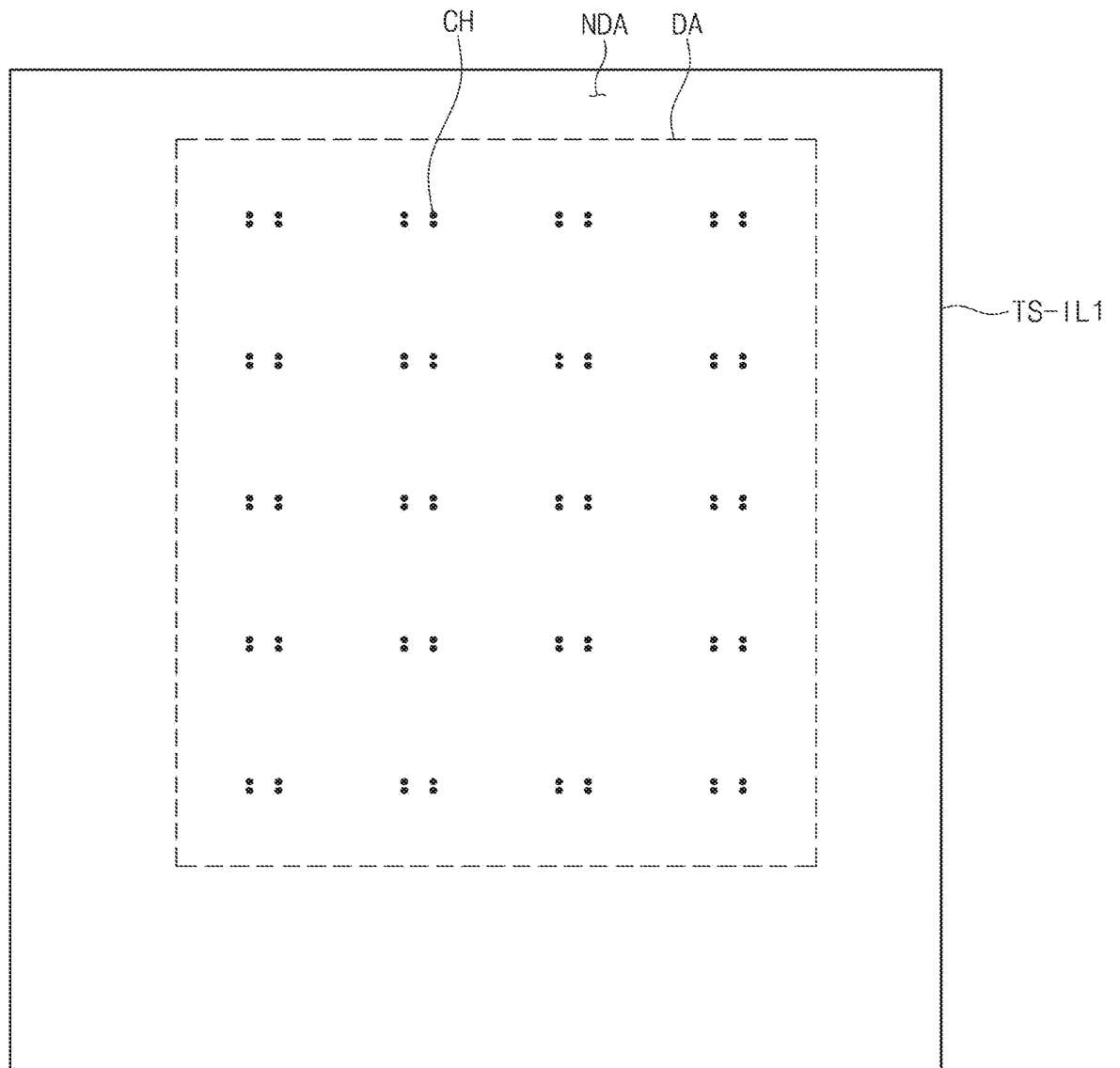


FIG. 8E

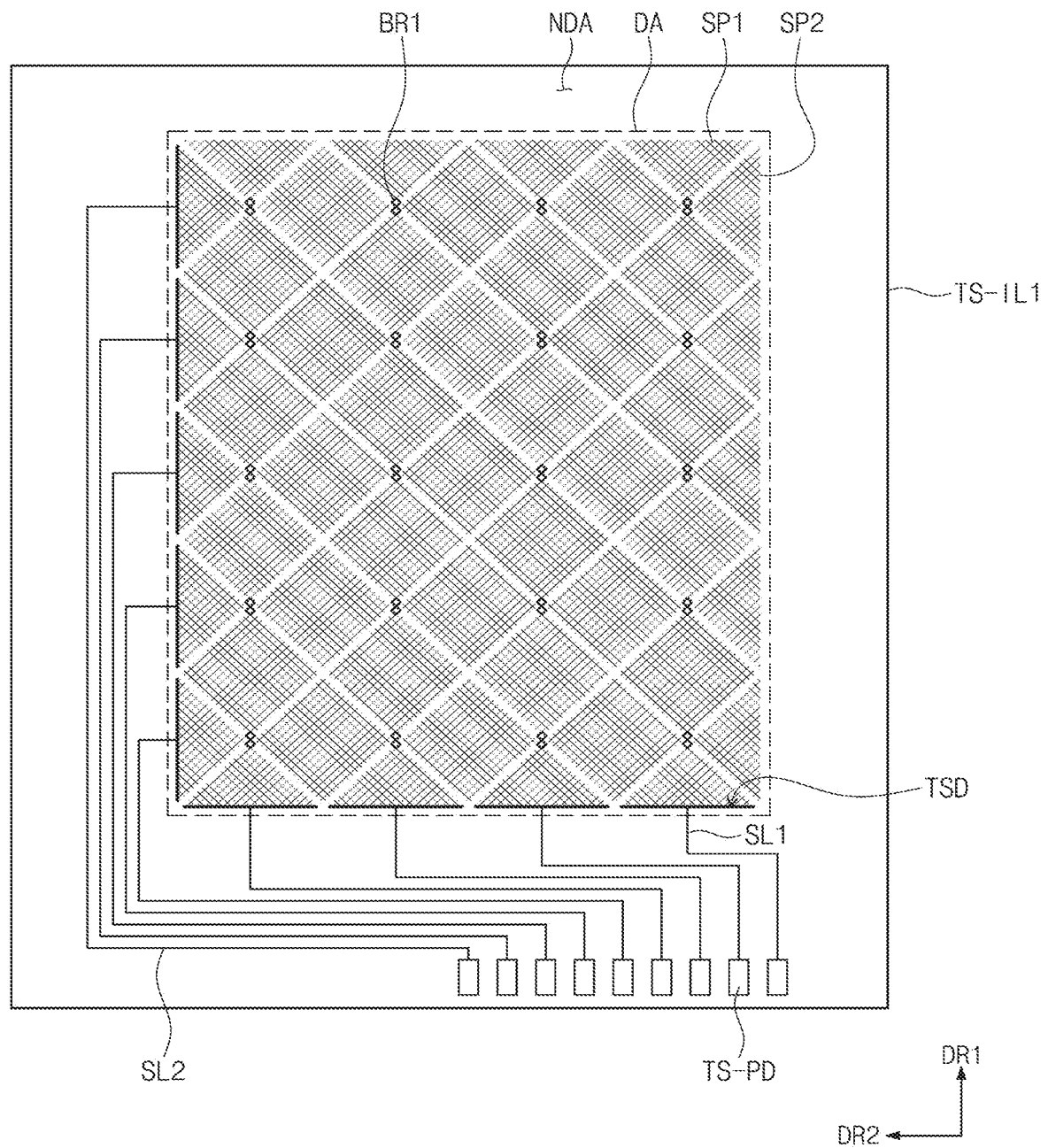


FIG. 8F

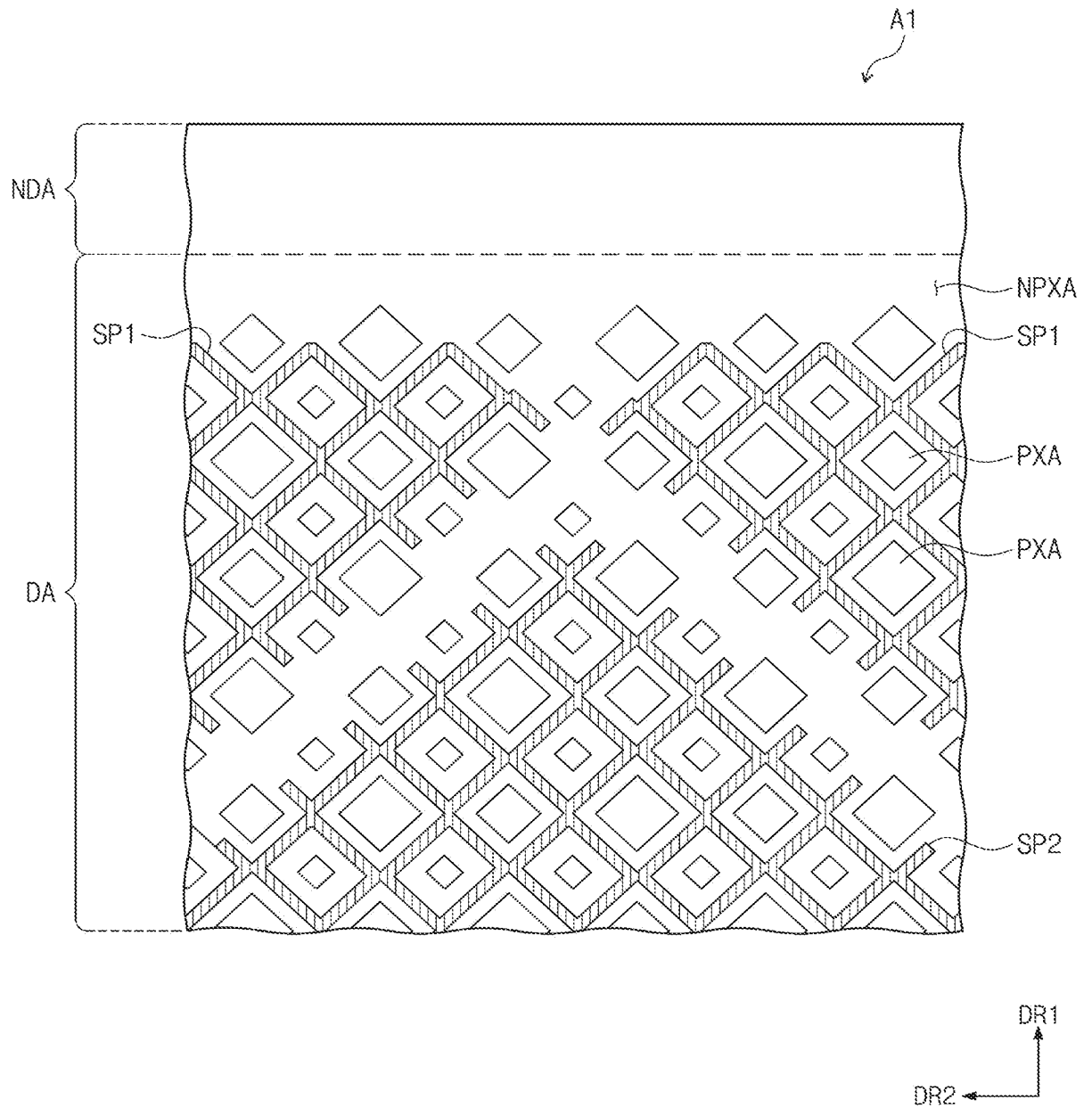


FIG. 9

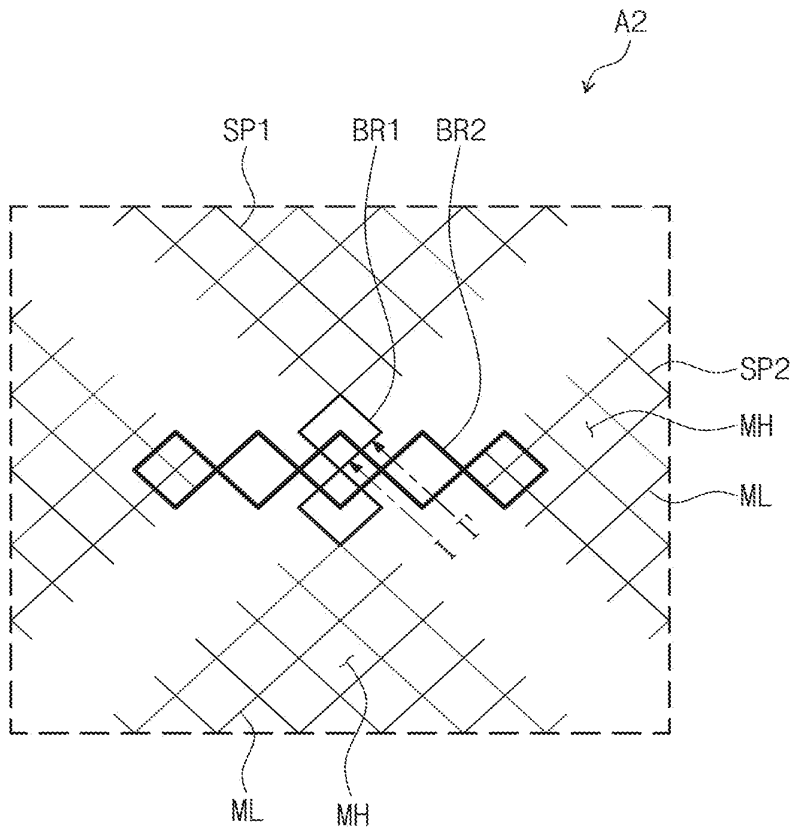


FIG. 10A

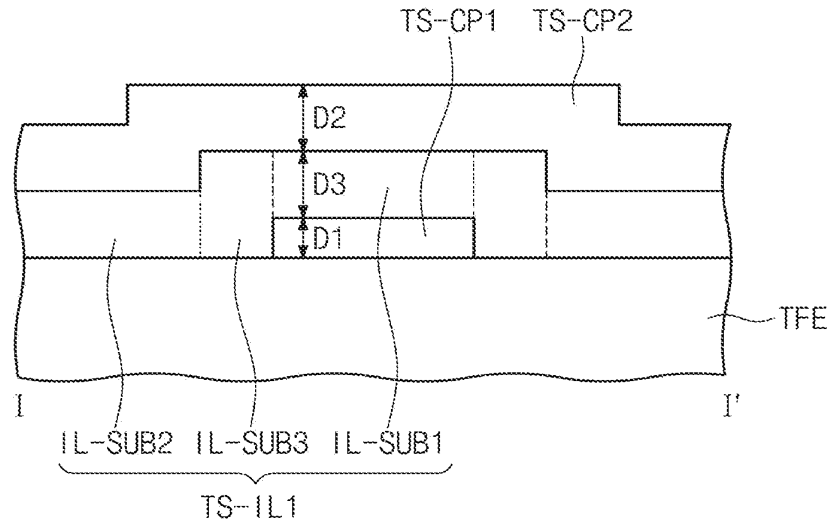


FIG. 10B

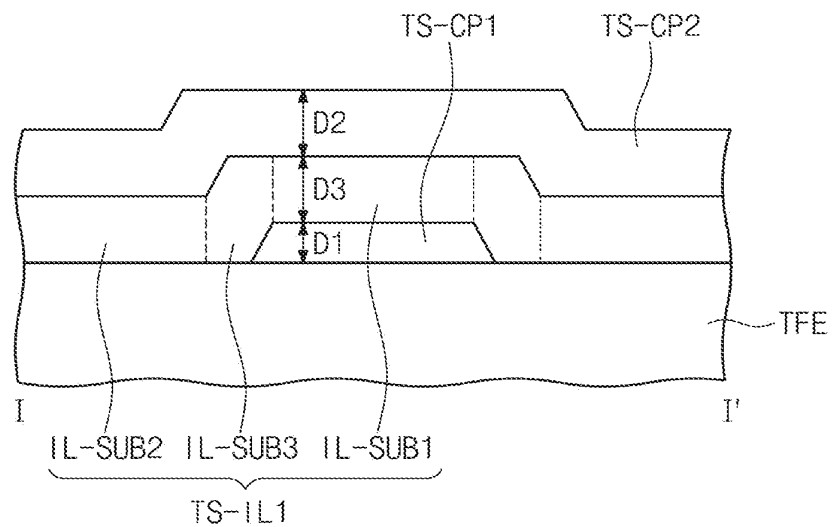


FIG. 11

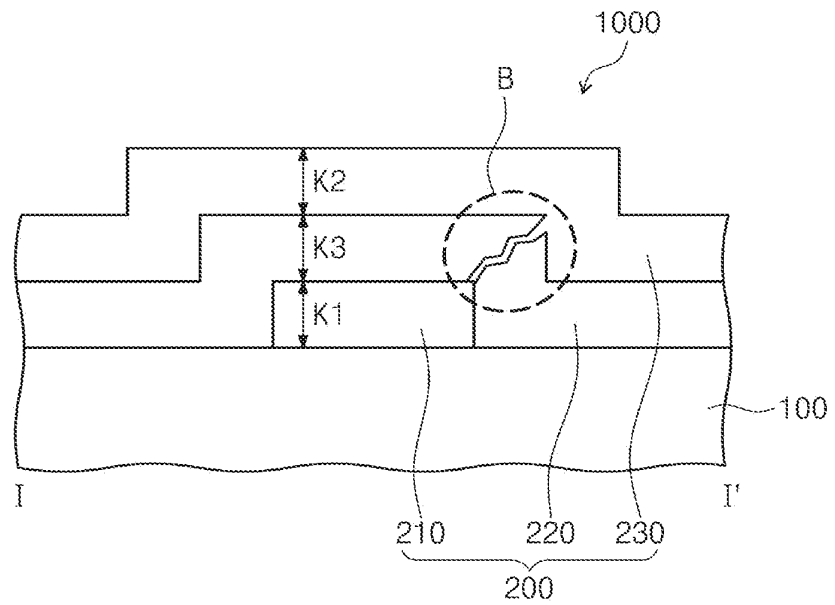


FIG. 12A

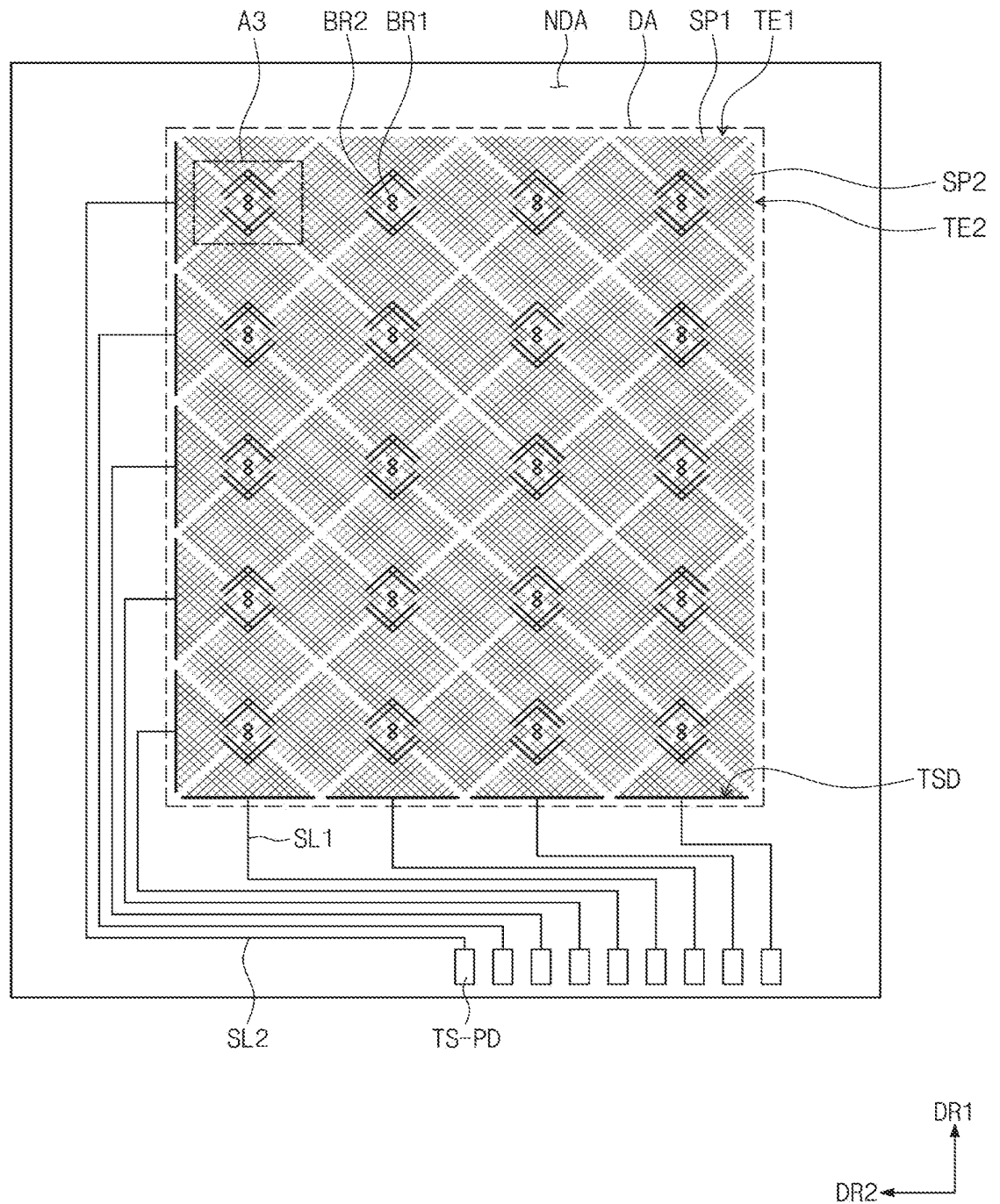


FIG. 12B

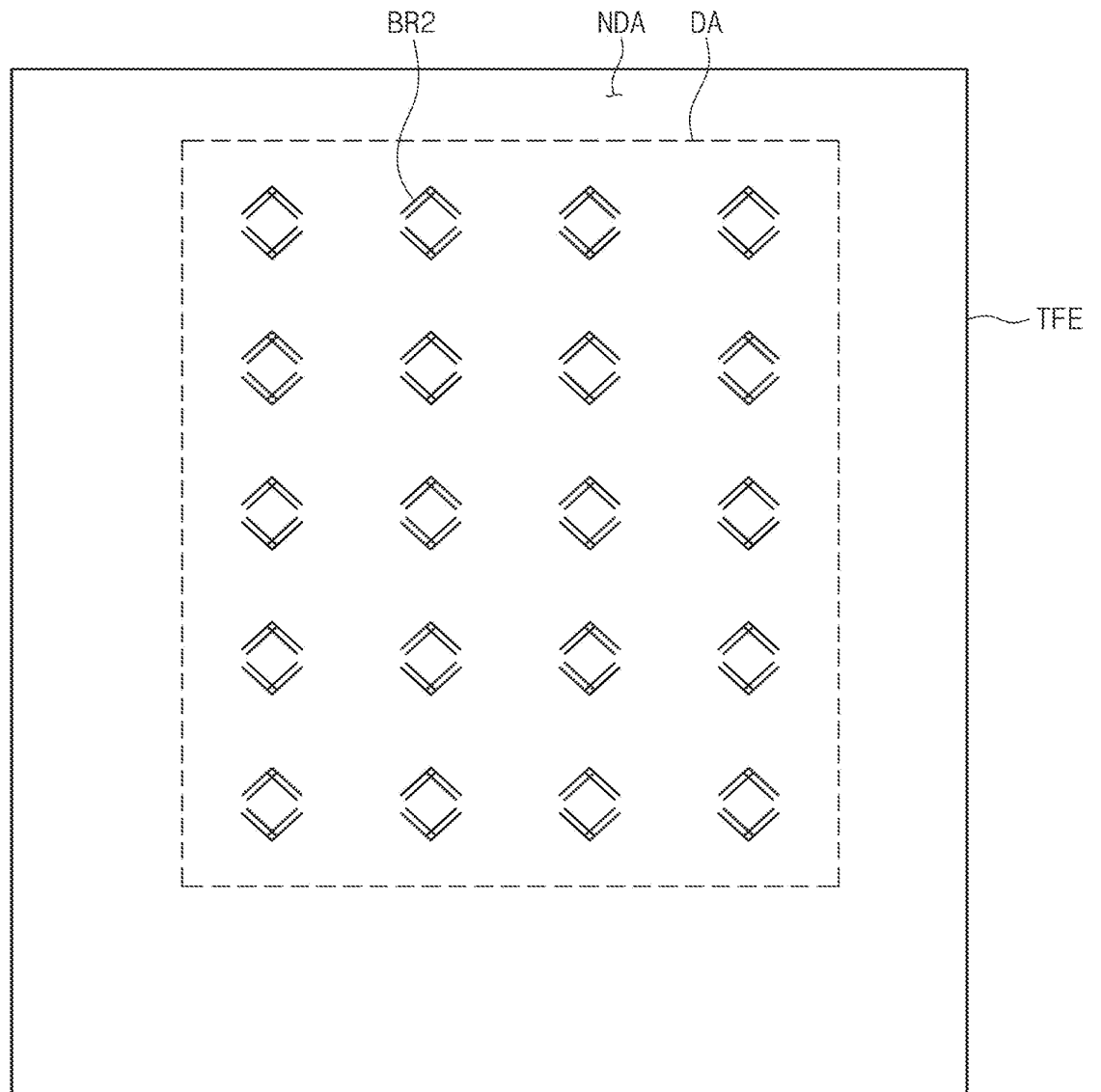


FIG. 12C

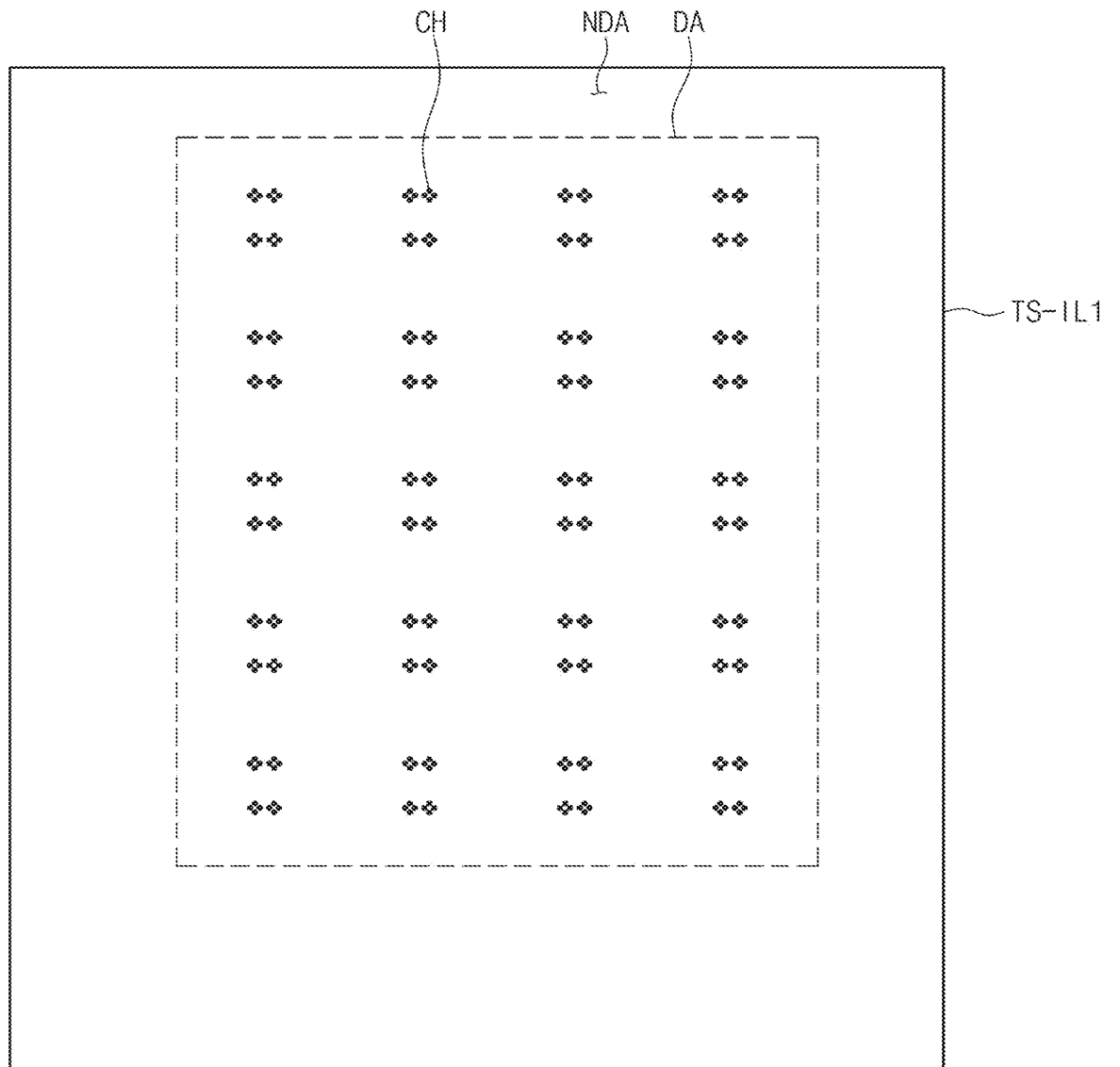


FIG. 12D

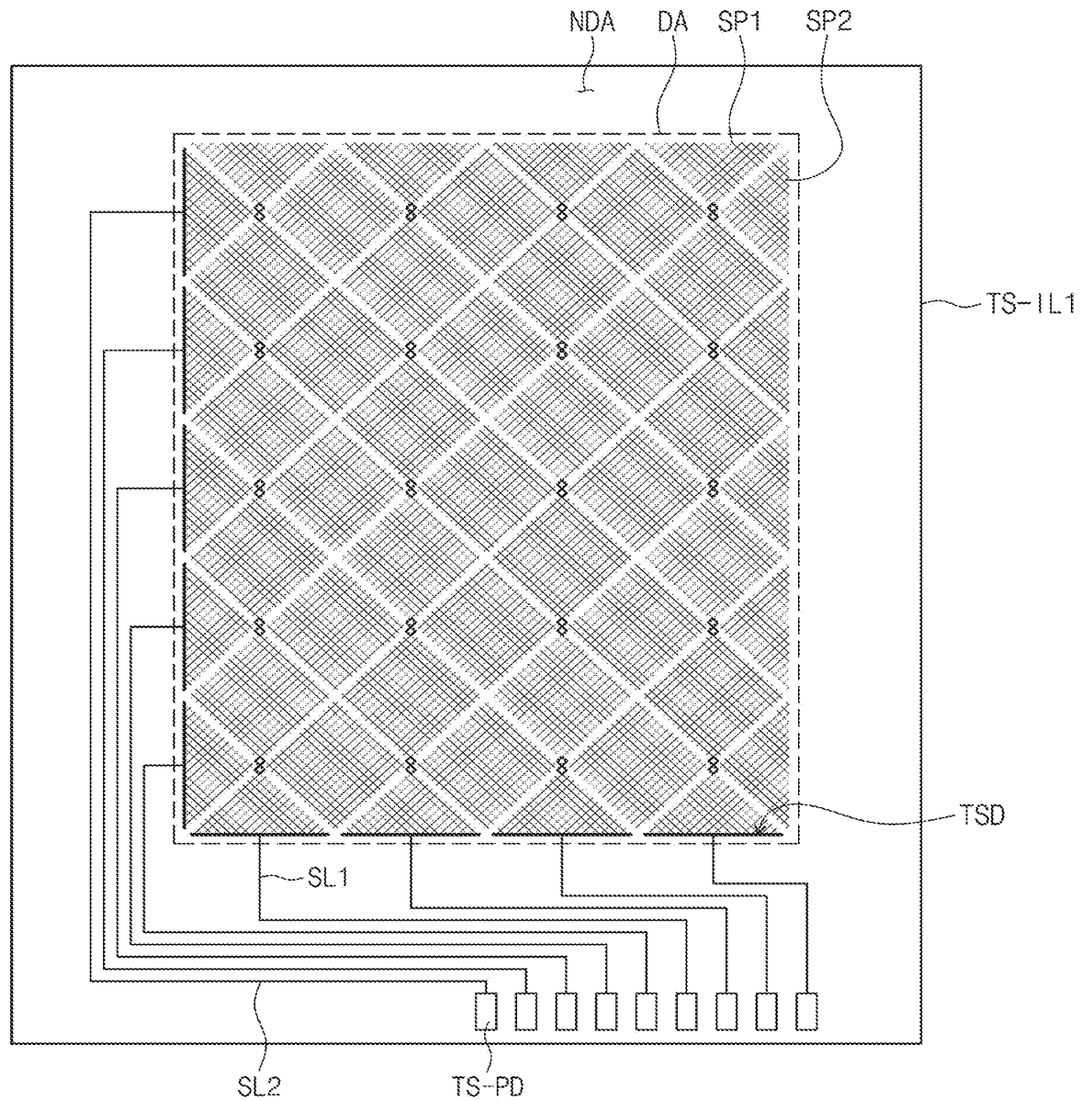


FIG. 13A

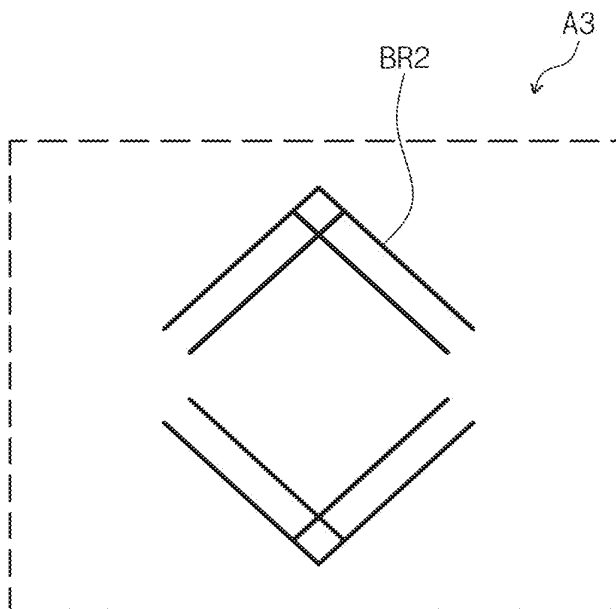


FIG. 13B

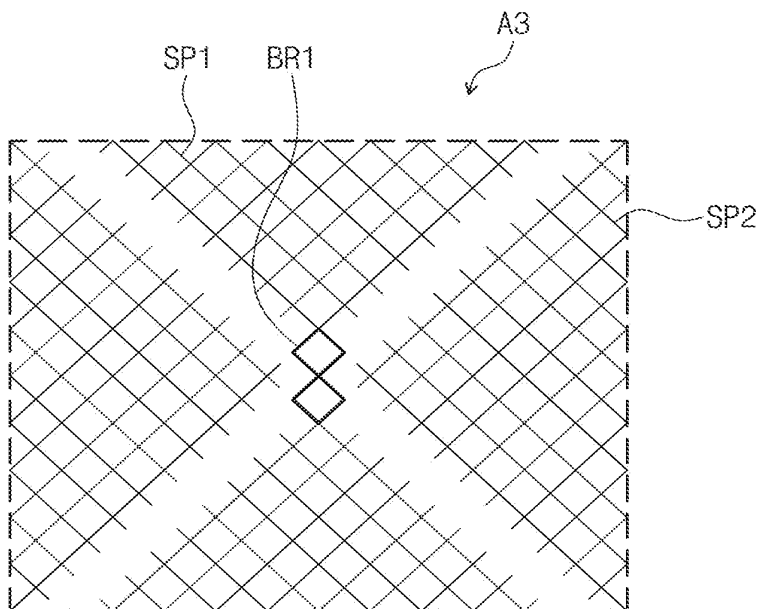


FIG. 13C

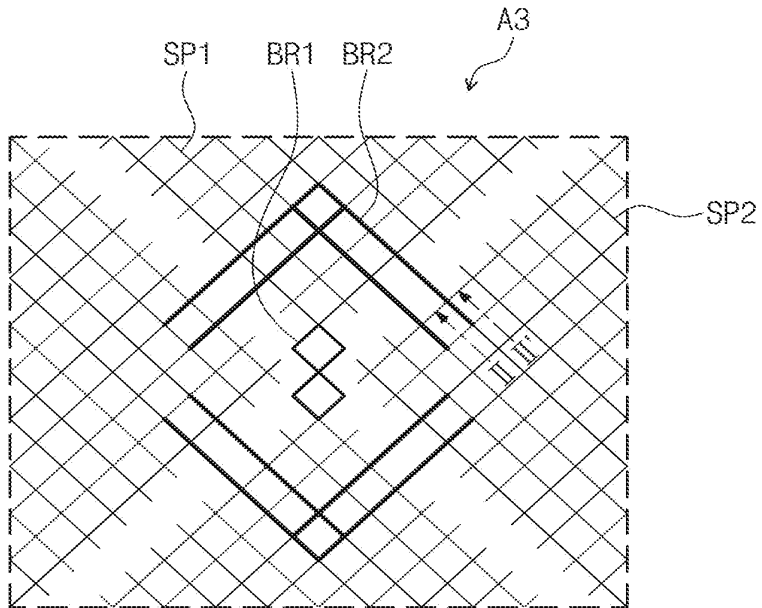


FIG. 14

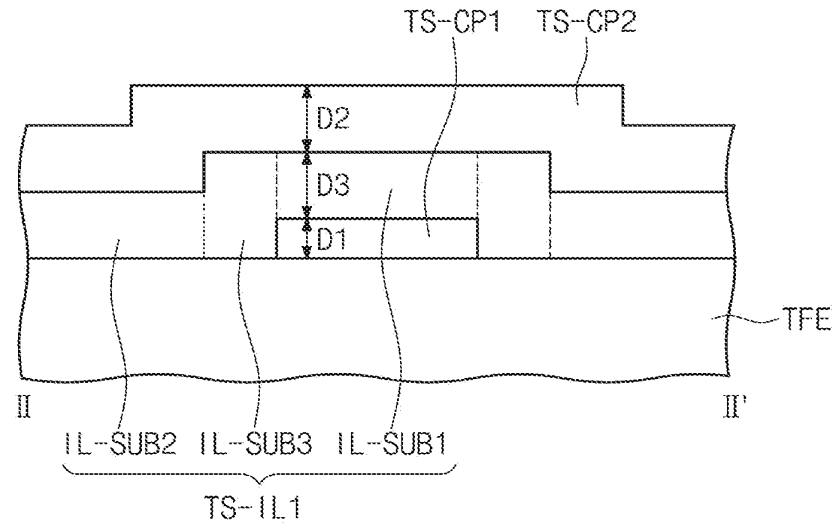


FIG. 15

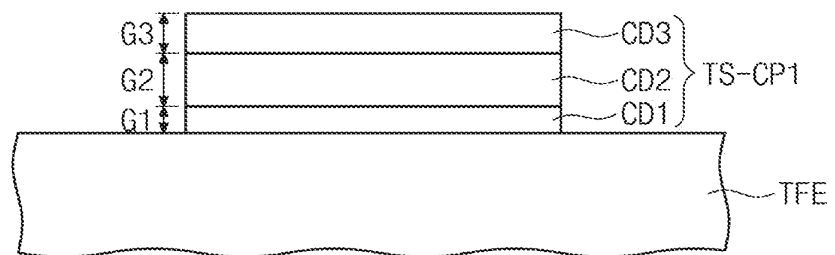
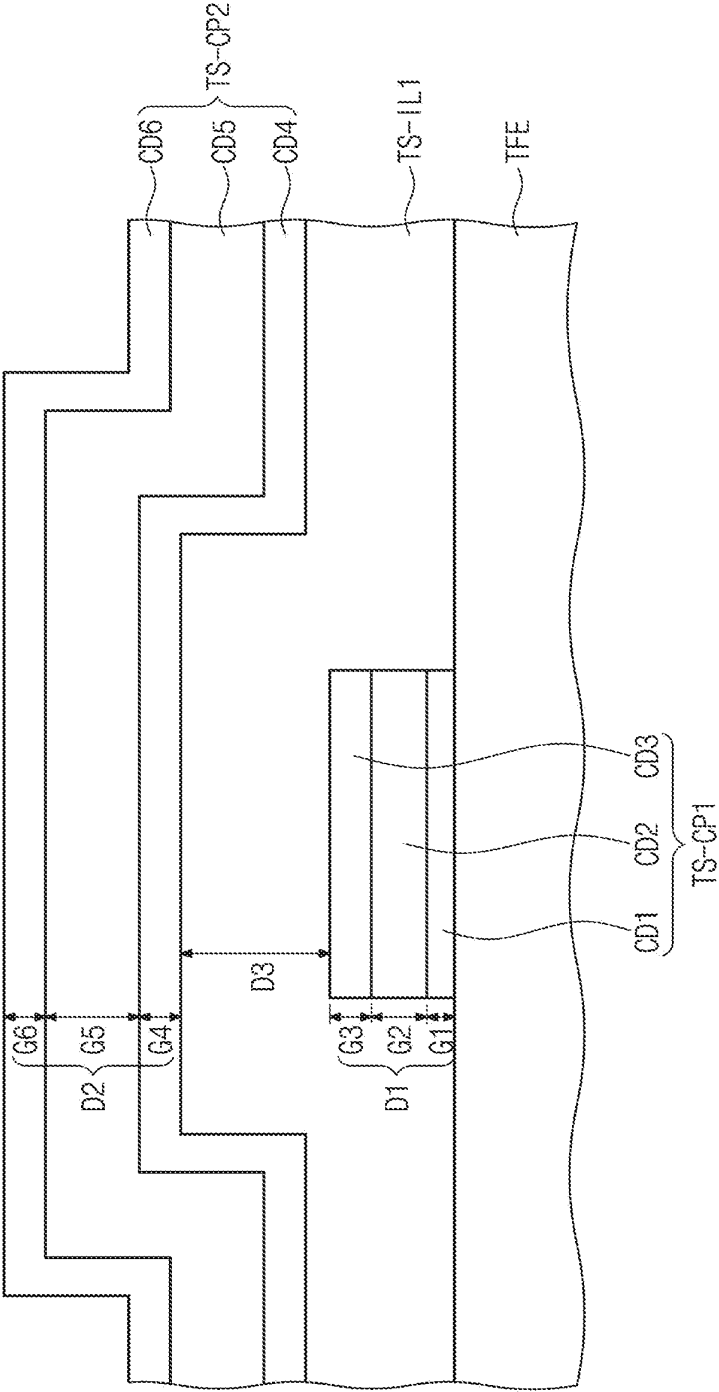


FIG. 16



INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)	Attorney Docket Number	183539
	Application Number	To Be Determined
	Filing Date	January 14, 2020
	Inventor(s)	Chiwook An, et al.
	Group Art Unit	To Be Determined
	Examiner Name	To Be Determined

U.S. PATENT DOCUMENTS				
EXAMINER INITIALS	Cite No. ¹	DOCUMENT NUMBER Number - Kind Code ² (If Known)	PUBLICATION DATE OR ISSUE DATE MM-DD-YYYY	NAME OF PATENTEE
		6,504,202 B1	01-07-2003	Allman et al.
		2010/0182273 A1	07-22-2010	Noguchi et al.
		2014/0320769 A1	10-30-2014	Masuda
		2015/0382446 A1	12-31-2015	Kwon et al.
		2016/0041644 A1	02-11-2016	Bae et al.
		2016/0103549 A1	04-14-2016	Lee et al.
		2016/0147335 A1	05-26-2016	Nishizawa et al.
		2016/0162060 A1	06-09-2016	Hong, et al.
		2017/0336907 A1	11-23-2017	Jeong et al.

FOREIGN PATENT DOCUMENTS					
EXAMINER INITIALS	Cite No. ¹	Foreign Patent Document Country Code ³ - Number ⁴ - Kind Code ⁵ (If Known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T ⁶ (✓)
		CN 103676826 A	03-26-2014	Beijing Time Cloud Elite Tech and Science Co. Ltd.	Abstract
		CN 104063039 A	09-24-2014	Huiling Zhu	Abstract
		CN 105282333 A	01-27-2016	Le Jinwei	Abstract
		KR 10-2014-0133401	11-19-2014	SAMSUNG ELECTRO-MECHANICS CO., LTD.	Korea Patent Abstract
		KR 10-2015-0022215	03-04-2015	SAMSUNG ELECTRO-MECHANICS CO., LTD.	Korea Patent Abstract
		KR 10-2016-0017830	02-17-2016	Bae et al.	Korea Patent Abstract, and Corresponds to U.S. Publication 2016/0041644 A1, listed above

EXAMINER SIGNATURE	DATE CONSIDERED
EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. ³ Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English Language Translation is attached.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)	Attorney Docket Number	183539
	Application Number	To Be Determined
	Filing Date	January 14, 2020
	Inventor(s)	Chiwook An, et al.
	Group Art Unit	To Be Determined
	Examiner Name	To Be Determined

FOREIGN PATENT DOCUMENTS					
EXAMINER INITIALS	Cite No. ¹	Foreign Patent Document Country Code ³ - Number ⁴ - Kind Code ⁵ (If Known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T ⁶ (✓)
		KR 10-2016-0043211	04-21-2016	Lee et al.	Korea Patent Abstract, and Corresponds to U.S. Publication 2016/0103549 A1, listed above
		KR 10-2016-0079280	07-06-2016	LG INNOTEK CO., LTD.	Abstract & Corresponds to U.S. Publication 2016/0162060, listed above
		WO 2014/058116 A1	04-17-2014	Hong et al.	
		WO 2014/168203 A1	10-16-2014	Shin-Etsu Polymer Co. Ltd.	Abstract

OTHER DOCUMENTS		
EXAMINER INITIALS	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
		EPO Extended Search Report dated November 29, 2017, for corresponding European Patent Application No. 17183323.9 (10 pages)

110231788.1 01/13/20 4:31PM

EXAMINER SIGNATURE	DATE CONSIDERED
EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. ³ Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English Language Translation is attached.	

JEJ/smv

Sheet 2 of 2

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on January 14, 2020 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.

Si Vuong

Inventor(s) : Chiwook An, et al.
Application No. : To Be Determined
Filed : January 14, 2020
Title : DISPLAY DEVICE
Grp./Div. : To Be Determined
Examiner : To Be Determined
Docket No. : 183539

**INFORMATION DISCLOSURE STATEMENT
FOR A CONTINUING NON-CPA APPLICATION**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
January 14, 2020

Commissioner:

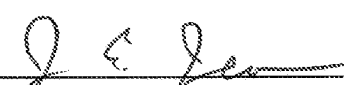
In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, enclosed is an information disclosure statement. The references listed thereon are not enclosed because they were of record in the parent application, Application No. 15/660,827, filed July 26, 2017.

It is respectfully requested that these references be considered in the examination of this application, and identified in the list of references cited on the patent issuing on this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

Respectfully submitted,

LEWIS ROCA ROTHGERBER CHRISTIE LLP

By


Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/smv
Information Disclosure Statement

110231684.1 01/13/20 4:20PM

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		DISPLAY DEVICE		
First Named Inventor/Applicant Name:		Chiwook An		
Filer:		Jun-Young E. Jeon/Si Vuong		
Attorney Docket Number:		183539/411598-04552		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1720

Electronic Acknowledgement Receipt	
EFS ID:	38290127
Application Number:	16742230
International Application Number:	
Confirmation Number:	7917
Title of Invention:	DISPLAY DEVICE
First Named Inventor/Applicant Name:	Chiwook An
Customer Number:	23363
Filer:	Jun-Young E. Jeon/Si Vuong
Filer Authorized By:	Jun-Young E. Jeon
Attorney Docket Number:	183539/411598-04552
Receipt Date:	14-JAN-2020
Filing Date:	
Time Stamp:	15:01:17
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1720
RAM confirmation Number	E20201DF01544009
Deposit Account	031728
Authorized User	Si Vuong
<p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>37 CFR 1.16 (National application filing, search, and examination fees)</p> <p>37 CFR 1.17 (Patent application and reexamination processing fees)</p>	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	183539_CONApplicationTransmittal.pdf	3796958	no	3
			09b61e81e83ea2fa8887287fc792dae06d105ba0		
Warnings:					
Information:					
2	Power of Attorney	183539_POA.pdf	1584295	no	2
			2b59d24da272b3d279c88c729868614da56f4302		
Warnings:					
Information:					
3	Oath or Declaration filed	183539_ParentDec_02032017.pdf	1081903	no	3
			e15887bd64d8e0f21b0fda3aa8b92ac0b98f43df		
Warnings:					
Information:					
4	Application Data Sheet	183539_ADS.pdf	1828503	no	9
			1619d58ac4f57666c0b2752bcea7d562bb28a671		
Warnings:					
Information:					
5		183539_CONApplicationAsFiled.pdf	192033	yes	45
			5a179988b0da7728119d7a5c6d66513e00b5a3e3		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Abstract		45	45	
	Claims		41	44	
	Specification		1	40	

Warnings:					
Information:					
6	Drawings-only black and white line drawings	183539_CONDrawingsAsFiled.pdf	10705195 651de7918ceb69f76320ba70f0688b26a172e54c	no	32
Warnings:					
Information:					
7		183539_IDS_011420.pdf	4359706 63bf8c7559ea7fd22d0e73f3636f5905a5eac4f2	yes	3
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Information Disclosure Statement (IDS) Form (SB08)		2	3	
	Transmittal Letter		1	1	
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	35074 cae9638d11a521593a9453d83b8f35836f38badb	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			23583667		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/742,230			
APPLICATION AS FILED - PART I									
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY			
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)		
BASIC FEE <small>(37 CFR 1.16(a), (b), or (c))</small>	N/A	N/A	N/A			N/A	300		
SEARCH FEE <small>(37 CFR 1.16(k), (l), or (m))</small>	N/A	N/A	N/A			N/A	660		
EXAMINATION FEE <small>(37 CFR 1.16(o), (p), or (q))</small>	N/A	N/A	N/A			N/A	760		
TOTAL CLAIMS <small>(37 CFR 1.16(j))</small>	16	minus 20 = *				x 100 =	0.00		
INDEPENDENT CLAIMS <small>(37 CFR 1.16(h))</small>	1	minus 3 = *				x 460 =	0.00		
APPLICATION SIZE FEE <small>(37 CFR 1.16(s))</small>	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00		
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00		
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	1720		
APPLICATION AS AMENDED - PART II									
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)	
	Total <small>(37 CFR 1.16(i))</small>	*	Minus **	=	x =		x =		
	Independent <small>(37 CFR 1.16(h))</small>	*	Minus ***	=	x =		x =		
	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
				TOTAL ADD'L FEE		TOTAL ADD'L FEE			
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)	
	Total <small>(37 CFR 1.16(i))</small>	*	Minus **	=	x =		x =		
	Independent <small>(37 CFR 1.16(h))</small>	*	Minus ***	=	x =		x =		
	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
				TOTAL ADD'L FEE		TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.									



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/742,230	01/14/2020	2812	1720	183539/411598-04552	16	1

CONFIRMATION NO. 7917

FILING RECEIPT



0000000114422488

23363

Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

Date Mailed: 02/04/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

Please verify the accuracy of the data presented on this receipt. If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

Inventor(s)

Chiwook AN, Hwaseong-si, KOREA, REPUBLIC OF;
Doyeon KIM, Seoul, KOREA, REPUBLIC OF;
Sunghyun PARK, Seongnam-si, KOREA, REPUBLIC OF;
Jaehyun LEE, Seoul, KOREA, REPUBLIC OF;
Sung-woong CHO, Asan-si, KOREA, REPUBLIC OF;

Applicant(s)

SAMSUNG DISPLAY CO., LTD., Yongin-si, KOREA, REPUBLIC OF;

Power of Attorney: The patent practitioners associated with Customer Number 23363

Domestic Priority data as claimed by applicant

This application is a CON of 15/660,827 07/26/2017 PAT 10541279

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

REPUBLIC OF KOREA 10-2016-0097493 07/29/2016 No Access Code Provided

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 02/03/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/742,230**

Projected Publication Date: 05/14/2020

Non-Publication Request: No

Early Publication Request: No
Title

DISPLAY DEVICE

Preliminary Class

438

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

page 2 of 4

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/742,230	01/14/2020	Chiwook AN	183539/411598-04552

CONFIRMATION NO. 7917

23363

Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

PUBLICATION NOTICE



OC000000117086363

Title:DISPLAY DEVICE

Publication No.US-2020-0152710-A1

Publication Date:05/14/2020

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publicly available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

<p align="center">INFORMATION DISCLOSURE</p> <p align="center">STATEMENT BY APPLICANT</p> <p align="center">(use as many sheets as necessary)</p>	Attorney Docket Number	183539
	Application Number	16/742,230
	Filing Date	January 14, 2020
	Inventor(s)	Chiwook An, et al.
	Group Art Unit	2621
	Examiner Name	AWAD, AMR A

U.S. PATENT DOCUMENTS				
EXAMINER INITIALS	Cite No. ¹	DOCUMENT NUMBER Number - Kind Code ² (If Known)	PUBLICATION DATE OR ISSUE DATE MM-DD-YYYY	NAME OF PATENTEE
		2010/0110023 A1	05-06-2010	Chien et al.
		2011/0193793 A1	08-11-2011	An et al.
		2015/0085205 A1	03-26-2015	Chen et al.

FOREIGN PATENT DOCUMENTS					
EXAMINER INITIALS	Cite No. ¹	Foreign Patent Document Country Code ³ - Number ⁴ - Kind Code ⁵ (If Known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T ⁶ (✓)

OTHER DOCUMENTS		
EXAMINER INITIALS	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.

EXAMINER SIGNATURE		DATE CONSIDERED	
<p>EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹Applicant's unique citation designation number (optional). ²See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. ³Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). ⁴For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶Applicant is to place a check mark here if English Language Translation is attached.</p>			

Electronic Acknowledgement Receipt	
EFS ID:	40086792
Application Number:	16742230
International Application Number:	
Confirmation Number:	7917
Title of Invention:	DISPLAY DEVICE
First Named Inventor/Applicant Name:	Chiwook AN
Customer Number:	23363
Filer:	Jun-Young E. Jeon/Felicia Sutphen
Filer Authorized By:	Jun-Young E. Jeon
Attorney Docket Number:	183539/411598-04552
Receipt Date:	23-JUL-2020
Filing Date:	14-JAN-2020
Time Stamp:	14:17:50
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		183539_SuppIDS.PDF	136557 3de0a5276da1a7bc89d09638e99059de1e07972f	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Form (SB08)	3	3
Warnings:			
Information:			
Total Files Size (in bytes):		136557	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on July 23, 2020 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.

/Felicia R. Sutphen/
Felicia R. Sutphen

Inventor(s) : Chiwook An, et al. Confirmation No. 7917
Application No. : 16/742,230
Filed : January 14, 2020
Title : DISPLAY DEVICE

Grp./Div. : 2621
Examiner : AWAD, AMR A

Docket No. : 183539

**SUPPLEMENTAL
INFORMATION DISCLOSURE STATEMENT
37 CFR § 1.97(b)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
July 23, 2020

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement listing the references that are known to applicant. Copies of each of the listed Foreign Patent Documents and Other Documents references are enclosed. This filing is timely because it is made during one of the periods described in 37 CFR § 1.97(b).

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

111801875.1

Application No.: 16/742,230

The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By /Jun-Young E. Jeon/
Jun-Young E. Jeon
Reg. No. 43,693
626/795-9900

JEJ/frs

Enclosures: Information Disclosure Statement, w/references



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/742,230	01/14/2020	Chiwook AN	183539/411598-04552	7917
23363	7590	11/17/2020	EXAMINER	
Lewis Roca Rothgerber Christie LLP			ELAHI, TOWFIQ	
PO BOX 29001			ART UNIT	PAPER NUMBER
Glendale, CA 91209-9001			2625	
			NOTIFICATION DATE	DELIVERY MODE
			11/17/2020	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pair_cph@firsttofile.com
pto@lrrc.com

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit <http://www.uspto.gov/forms/>. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to <http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp>.

2. Claim 1 rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 and claim 4 of US 10541279 in view of Kwon (US 20140232956). Although the claims at issue are not identical, they are not patentably distinct from each other.

Claim 1 of this Application	US 10541279
-----------------------------	-------------

<p>1. A display device comprising: an organic light emitting device layer; a thin film encapsulation layer on the organic light emitting device layer; a buffer layer directly on the thin film encapsulation layer; and a touch sensing unit directly on the buffer layer, the touch sensing unit comprising:</p> <p>a first conductive pattern on the buffer layer; an insulating layer covering the first conductive pattern; and a second conductive pattern on the insulating layer, the second conductive pattern partially crossing the first conductive pattern, and</p> <p>having a thickness that is greater than a thickness of the first conductive pattern.</p>	<p>1. A display device comprising: a display panel; and</p> <p>a touch sensing unit on the display panel, the touch sensing unit comprising:</p> <p>a first conductive pattern on the display panel; an insulating layer covering the first conductive pattern; and a second conductive pattern on the insulating layer, partially crossing the first conductive pattern, and</p> <p>comprising: first touch sensor parts; second touch sensor parts spaced from the first touch sensor parts; and first connection parts connecting respective ones of the first touch sensor parts, wherein the first conductive pattern comprises electrically conductive second connection parts connecting respective ones of the second touch sensor parts, and wherein the second conductive pattern has a thickness that is greater than a thickness of the second connection parts.</p> <p>4. The display device of claim 1, wherein the thickness of the first conductive pattern is equal to or greater than about 1800 angstroms, and equal to or less than about 2100 angstroms, and wherein the thickness of the second conductive pattern is equal to or greater than about 2700 angstroms, and equal to or less than about 3500 angstroms.</p>
--	--

	<p>19. The display device of claim 1, wherein the display panel comprises: a base layer; a circuit layer on the base layer; an organic light emitting device layer on the circuit layer; and a thin film encapsulation layer on the organic light emitting device layer.</p>
--	--

US 10541279 do not expressly disclose a buffer layer directly on the thin film encapsulation layer.

But in similar art Kwon disclosed a buffer layer (fig. 1E, item 181) directly on the thin film encapsulation layer (fig. 1, item 188)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine current application with Kwon teaching so that it may include a buffer layer directly on the thin film encapsulation layer.

The motivation is simple substitution of known element to yield predictable results.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112(a):

(a) IN GENERAL.—The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor or joint inventor of carrying out the invention.

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 1 rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 1 recites “a buffer layer directly on the thin film encapsulation layer” and “a touch sensing unit directly on the buffer layer” However specification does not support this recitation.

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 1 recites "a buffer layer directly on the thin film encapsulation layer" and "a touch sensing unit directly on the buffer layer". However, in light it is not clear how a buffer layer is directly on the thin film encapsulation layer and how "a touch sensing unit directly on the buffer layer". Therefore deemed indefinite. All of the dependent claims are also rejected as such.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 1-5, 14-15 is/are rejected under 35 U.S.C. 103 as being unpatentable over Zhu (US 20160313837) in view of Kwon (US 20140232956) and Allman (US 6504202).

Regarding **claim 1** Zhu disclosed a display device (fig.1) comprising:

an organic light emitting device layer (fig. 1, item 104);

a thin film encapsulation layer (fig. 1, item 106) on the organic light emitting device layer;

a touch sensing unit (fig. 1, items comprising 105 and 107) directly on the buffer layer (fig. 1, item 102), the touch sensing unit comprising:

a first conductive pattern (fig. 1, item 105) on the buffer layer (fig. 1, item 106);

an insulating layer covering the first conductive pattern ([0074] As being different from

Embodiment 1, in the present embodiment, separating pillars 109 adapted for

separating the second electrodes are configured on the substrate 101, so as to rendering the first conductive units 105 insulated from one another); and a second conductive pattern on the insulating layer (fig. 1, ABSTRACT: the second conductive units (107) are configured to be insulated from each other), the second conductive pattern partially crossing the first conductive pattern (fig.2-3, item 105 and 107 partially crossing).

Zhu does not expressly teach a buffer layer directly on the thin film encapsulation layer; and the second conductive pattern having a thickness that is greater than a thickness of the first conductive pattern.

However Kwon teach a buffer layer (fig. 1E, item 181) directly on the thin film encapsulation layer (fig. 1E, item 188).

Therefore it would have been obvious to one of the ordinary skilled in the art before effective filing date to combine Zhu in light of Kwon so that it may include a buffer layer directly on the thin film encapsulation layer.

The motivation is simple substitution of known element to yield predictable results.

Zhu does not expressly teach the second conductive pattern having a thickness that is greater than a thickness of the first conductive pattern.

However Allman teach the second conductive pattern having a thickness that is greater than a thickness of the first conductive pattern (Fig. 5, shows second metal layer 38 thicker than first conductive layer 34 and third conductive layer 40).

Therefore it would have been obvious to one of the ordinary skilled in the art before effective filing date to combine Zhu in light of Allman so that it may include

The motivation is simple substitution of known element to yield predictable results.

Regarding **claim 2** Zhu disclosed wherein the first conductive pattern (fig. 1, item 105) is directly on the buffer layer (fig. 1, fig. 1, item 106).

Regarding **claim 3** Zhu disclosed wherein the buffer layer comprises at least one of a silicon nitride, a silicon-oxy-nitride, and a silicon oxide ([0056]).

Regarding **claim 4** Zhu disclosed wherein the thin film encapsulation layer comprises: a first inorganic layer; an organic layer on the first inorganic layer; and a second inorganic layer on the organic layer ([0056] Both of the first encapsulation layer 106 and the second encapsulation layer 108 comprise a single layer of or multiple alternately arranged layers of organic films and/or inorganic films. The inorganic film is selected from but not limited to silicon nitride film, silicon oxide film. The organic film is selected from but not limited to ultraviolet ray curable resin film, silicon dioxide--acrylic resin composite material film).

Regarding **claim 5** Zhu disclosed wherein the buffer layer is directly on the second inorganic layer.

Regarding **claim 14** Zhu disclosed wherein the second conductive pattern comprises:

first touch sensor parts; second touch sensor parts spaced from the first touch sensor parts (fig1, item 105, 107 spaced from each other); and
first connection parts connecting respective ones of the first touch sensor parts, wherein the first conductive pattern comprises electrically conductive second connection parts connecting respective ones of the second touch sensor parts (fig. 2).

Regarding **claim 15** Zhu disclosed wherein the second connection parts (fig. 1, item 107) are directly on the buffer layer (fig. 1, item 106).

Claim 7 is/are rejected under 35 U.S.C. 103 as being unpatentable over Zhu (US 20160313837) in view of Kwon (US 20140232956) and Allman (US 6504202) and further in view of Sonoda (US 20170176803).

Regarding **claim 7** Zhu does not expressly teach wherein each of the second conductive layer and the fifth conductive layer comprises aluminum (Al), and wherein each of the first conductive layer, the third conductive layer, the fourth conductive layer and the sixth conductive layer comprises titanium (Ti).

However Sonoda teach wherein each of the second conductive layer and the fifth conductive layer comprises aluminum (Al), and wherein each of the first conductive layer, the third conductive layer, the fourth conductive layer and the sixth conductive layer comprises titanium (Ti) ([0144]- [0146]).

Therefore it would have been obvious to one of the ordinary skilled in the art before effective filing date to combine Zhu in light of Sonoda so that it may include wherein each of the second conductive layer and the fifth conductive layer comprises aluminum (Al), and wherein each of the first conductive layer, the third conductive layer, the fourth conductive layer and the sixth conductive layer comprises titanium (Ti).

The motivation is simple substitution of known element to yield predictable results.

Claim 16 is/are rejected under 35 U.S.C. 103 as being unpatentable over Zhu (US 20160313837) in view of Kwon (US 20140232956) and Allman (US 6504202) and further in view of Lee (US 20160103549).

Regarding **claim 16** Zhu does not expressly teach thickness of the insulating layer is less than a thickness of the second conductive pattern.

However Lee teach thickness of the insulating layer (fig. 4C insulating layer 421) is less than a thickness of the second conductive pattern (fig. 4C, item 410).

Therefore it would have been obvious to one of the ordinary skilled in the art before effective filing date to combine Zhu in light of Lee so that it may include thickness of the insulating layer is less than a thickness of the second conductive pattern.

The motivation is simple substitution of known element to yield predictable results.

Allowable Subject Matter

Claims 6, 8-13 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Hotelling et. al. US 20060097991.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TOWFIQ ELAHI whose telephone number is (571)270-1687. The examiner can normally be reached on M-F: 10AM-3PM.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William Boddie can be reached on (571)272-0666. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see <https://ppair->

[my.uspto.gov/pair/PrivatePair](https://ppair-my.uspto.gov/pair/PrivatePair). Should you have questions on access to the Private

PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/TOWFIQ ELAHI/
Primary Examiner, Art Unit 2625

Notice of References Cited	Application/Control No. 16/742,230	Applicant(s)/Patent Under Reexamination AN et al.	
	Examiner TOWFIQ ELAHI	Art Unit 2625	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20160103549-A1	04-2016	LEE; Sangwook	G06F3/044	345/173
*	B	US-6504202-B1	01-2003	Allman; Derryl D. J.	H01L28/40	257/303
*	C	US-20170176803-A1	06-2017	SONODA; Daisuke	G02F1/13306	1/1
*	D	US-20160313837-A1	10-2016	ZHU; Shaopeng	G06F3/044	1/1
*	E	US-20140232956-A1	08-2014	Kwon; Seyeoul	G02F1/133305	349/12
*	F	US-20060097991-A1	05-2006	Hotelling; Steve	G06F3/04166	345/173
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20200729

<i>Search Notes</i> 	Application/Control No. 16/742,230	Applicant(s)/Patent Under Reexamination AN et al.
	Examiner TOWFIQ ELAHI	Art Unit 2625

CPC - Searched*		
Symbol	Date	Examiner
H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256	07/30/2020	TE

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Text searched in EAST	07/30/2020	TE

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

--	--

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)	Attorney Docket Number	183539
	Application Number	To Be Determined
	Filing Date	January 14, 2020
	Inventor(s)	Chiwook An, et al.
	Group Art Unit	To Be Determined
	Examiner Name	To Be Determined

U.S. PATENT DOCUMENTS				
EXAMINER INITIALS	Cite No. ¹	DOCUMENT NUMBER Number - Kind Code ² (If Known)	PUBLICATION DATE OR ISSUE DATE MM-DD-YYYY	NAME OF PATENTEE
		6,504,202 B1	01-07-2003	Allman et al.
		2010/0182273 A1	07-22-2010	Noguchi et al.
		2014/0320769 A1	10-30-2014	Masuda
		2015/0382446 A1	12-31-2015	Kwon et al.
		2016/0041644 A1	02-11-2016	Bae et al.
		2016/0103549 A1	04-14-2016	Lee et al.
		2016/0147335 A1	05-26-2016	Nishizawa et al.
		2016/0162060 A1	06-09-2016	Hong, et al.
		2017/0336907 A1	11-23-2017	Jeong et al.

FOREIGN PATENT DOCUMENTS					
EXAMINER INITIALS	Cite No. ¹	Foreign Patent Document Country Code ³ - Number ⁴ - Kind Code ⁵ (If Known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T ⁶ (✓)
		CN 103676826 A	03-26-2014	Beijing Time Cloud Elite Tech and Science Co. Ltd.	Abstract
		CN 104063039 A	09-24-2014	Huiling Zhu	Abstract
		CN 105282333 A	01-27-2016	Le Jinwei	Abstract
		KR 10-2014-0133401	11-19-2014	SAMSUNG ELECTRO-MECHANICS CO., LTD.	Korea Patent Abstract
		KR 10-2015-0022215	03-04-2015	SAMSUNG ELECTRO-MECHANICS CO., LTD.	Korea Patent Abstract
		KR 10-2016-0017830	02-17-2016	Bae et al.	Korea Patent Abstract, and Corresponds to U.S. Publication 2016/0041644 A1, listed above

EXAMINER SIGNATURE	/TOWFIQ ELAHI/	DATE CONSIDERED	07/30/2020
EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. ³ Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English Language Translation is attached.			

JEJ/smv

Sheet 1 of 2

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)	Attorney Docket Number	183539
	Application Number	To Be Determined
	Filing Date	January 14, 2020
	Inventor(s)	Chiwook An, et al.
	Group Art Unit	To Be Determined
	Examiner Name	To Be Determined

FOREIGN PATENT DOCUMENTS					
EXAMINER INITIALS	Cite No. ¹	Foreign Patent Document Country Code ³ - Number ⁴ - Kind Code ⁵ (If Known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T ⁶ (✓)
		KR 10-2016-0043211	04-21-2016	Lee et al.	Korea Patent Abstract, and Corresponds to U.S. Publication 2016/0103549 A1, listed above
		KR 10-2016-0079280	07-06-2016	LG INNOTEK CO., LTD.	Abstract & Corresponds to U.S. Publication 2016/0162060, listed above
		WO 2014/058116 A1	04-17-2014	Hong et al.	
		WO 2014/168203 A1	10-16-2014	Shin-Etsu Polymer Co. Ltd.	Abstract

OTHER DOCUMENTS		
EXAMINER INITIALS	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.
		EPO Extended Search Report dated November 29, 2017, for corresponding European Patent Application No. 17183323.9 (10 pages)

110231788.1 01/13/20 4:31PM

EXAMINER SIGNATURE	/TOWFIQ ELAHI/	DATE CONSIDERED	07/30/2020
<small>EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹Applicant's unique citation designation number (optional). ²See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. ³Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). ⁴For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶Applicant is to place a check mark here if English Language Translation is attached.</small>			

JEJ/smv

Sheet 2 of 2

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.E/

Bibliographic Data

Application No: 16/742,230

Foreign Priority claimed: ☒ Yes ☐ No

35 USC 119 (a-d) conditions met: ☒ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /TOWFIQ ELAHI/

Examiner's Signature

Initials

Title: DISPLAY DEVICE

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
01/14/2020	345	2625	183539/411598-04552
RULE			

APPLICANTS

SAMSUNG DISPLAY CO., LTD., Yongin-si, KOREA, REPUBLIC OF

INVENTORS

Chiwook AN, Hwaseong-si, KOREA, REPUBLIC OF

Doyeon KIM, Seoul, KOREA, REPUBLIC OF

Sunghyun PARK, Seongnam-si, KOREA, REPUBLIC OF

Jaehyun LEE, Seoul, KOREA, REPUBLIC OF

Sung-woong CHO, Asan-si, KOREA, REPUBLIC OF

CONTINUING DATA

This application is a CON of 15660827 07/26/2017 PAT 10541279

FOREIGN APPLICATIONS

KOREA, REPUBLIC OF 10-2016-0097493 07/29/2016

IF REQUIRED, FOREIGN LICENSE GRANTED**

02/03/2020

STATE OR COUNTRY

KOREA, REPUBLIC OF

ADDRESS

Lewis Roca Rothgerber Christie LLP

PO BOX 29001

Glendale, CA 91209-9001

UNITED STATES

FILING FEE RECEIVED

\$1,720

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	first conductive layer near3 buffer layer same second conductive layer same first conductive layer third conductive layer near3 second conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 15:40
L2	2	second conductive pattern near4 fourth conductive layer same insulating layer same fifth conductive layer same fourth conductive layer same sixth conductive layer same fifth conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 15:52
L3	3	second conductive layer same fifth conductive layer near3 aluminum	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 15:55
L4	9	thickness near3 second conductive layer near3 greater near4 thickness near3 first conductive layer near3 thickness near4 third conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 16:38
L5	1	(thickness or width) near3 fifth conductive layer near3 (greater or bigger or larger) near4 (thickness or width) near3 fifth conductive layer near3 (thickness or width) near3 sixth conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 16:43
L6	0	thicknessnear3 insulating layer near3 less near3 thickness near3 second conductive pattern	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:00
L7	1	thickness near3 insulating layer near3 less near3 thickness near3 second conductive pattern	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:00
L8	6	thickness near3 insulating layer near3 less near3 thickness near3 conductive pattern	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:01
L9	2	"20160103549"	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:07
L10	3	(thickness or width) near3 second conductive layer near3 (less or smaller) near3 (thickness or width) near3 fifth conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:20
L11	1	(thickness or width) near3 (difference or variation) near3 second conductive layer near3 first conductive layer near3 greater near3 (thickness or width) near3	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:23

		(difference or variation) near3 third conductive layer near3 first conductive layer				
L12	1	(thickness or width) near3 (difference or variation) near3 fifth conductive layer near3 fourth conductive layer near3 greater near3 (thickness or width) near3 (difference or variation) near3 sixth conductive layer near3 fourth conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:25
L13	1	(thickness or width) near3 (difference or variation) near3 fifth conductive layer near3 fourth conductive layer near3 greater near3 (thickness or width) near3 (difference or variation) near3 second conductive layer near3 first conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:26
L14	2	"20100110023"	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:34
L15	2	"20110193793"	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:34
L16	1	"20150085205"	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:35
L22	2	"20160162060"	US-PGPUB; USPAT	OR	OFF	2020/07/30 17:39
L23	2	"20170336907"	US-PGPUB; USPAT	OR	OFF	2020/07/30 17:39
S1	1	"15660827"	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:03
S2	13	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:06
S3	0	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern same touch	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:06
S4	0	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern and touch	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:07

S5	14	insula\$3 near2 pattern near3 between same first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:09
S6	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:10
S7	2	"20160103549"	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:22
S8	1	"20160147335"	US-PGPUB; USPAT	OR	OFF	2018/09/04 15:02
S9	1	"20170336907"	US-PGPUB; USPAT	OR	OFF	2018/09/04 15:05
S10	2	"20140160066"	US-PGPUB; USPAT	OR	OFF	2018/09/04 15:14
S11	0	((("AN") near3 ("Chiwook"))).INV.	USPAT	OR	OFF	2018/09/04 15:18
S12	12	((("KIM") near3 ("Doyeon"))).INV.	US-PGPUB	OR	OFF	2018/09/04 15:18
S13	8	((("PARK") near3 ("Sunghyun"))).INV.	USPAT	OR	OFF	2018/09/04 15:19
S14	21	((("LEE") near3 ("Jaehyun"))).INV.	USPAT	OR	OFF	2018/09/04 15:19
S15	0	((("CHO") near3 ("Sung-woong"))).INV.	USPAT	OR	OFF	2018/09/04 15:19
S16	0	((("CHO") near3 ("Sung-woong"))).INV.	USPAT	OR	OFF	2018/09/04 15:20
S17	4	insula\$3 near2 pattern near3 between same first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern and display	US-PGPUB; USPAT	OR	OFF	2018/09/05 10:04
S18	0	touch near3 (sens\$3 detect\$3) near3 on near3 display near3 (part section substrate)	US-PGPUB; USPAT	OR	OFF	2018/09/05 10:06
S19	196	touch near3 (sens\$3 detect\$3) near3 display near3 (part section substrate) same insulat\$3	US-PGPUB; USPAT	OR	OFF	2018/09/05 10:07
S20	35,861	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2018/09/05 10:09

S21	170	S19 and S20	US-PGPUB; USPAT	OR	OFF	2018/09/05 10:10
S22	1	"20160147335"	US-PGPUB; USPAT	OR	OFF	2018/09/05 13:37
S23	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2018/09/06 08:59
S24	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2018/09/06 08:59
S25	2	"20160103549"	US-PGPUB; USPAT	OR	OFF	2018/09/06 08:59
S26	0	(first second third) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third) near3 layer	US-PGPUB; USPAT	OR	OFF	2018/09/06 09:55
S27	0	(first second third one) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third) near3 layer	US-PGPUB; USPAT	OR	OFF	2018/09/06 09:56
S28	0	(first second third one) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third other another) near3 layer	US-PGPUB; USPAT	OR	OFF	2018/09/06 09:57
S29	0	conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third other another) near3 layer	US-PGPUB; USPAT	OR	OFF	2018/09/06 09:57
S30	0	conductive near3 layer near3 resistivi near3 (less lower different) near3 (first second third other another) near3 layer	US-PGPUB; USPAT	OR	OFF	2018/09/06 09:57
S31	1,122,191	(first second third other another) near3 layer conductive near3 layers near3 resistivi near3 (less lower different)	US-PGPUB; USPAT	OR	OFF	2018/09/06 09:58
S32	35,893	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2018/09/06 09:59
S33	15,461	S31 and S32	US-PGPUB; USPAT	OR	OFF	2018/09/06 09:59
S34	1,122,172	(first second third) near3 layer conductive near3 layers near3 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:00

S35	15,461	S32 and S34	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:00
S36	1,556,030	(first second third one) near3 layer conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same than near3 (first second third other another)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:02
S37	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same than near3 (first second third other another)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:03
S38	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same (first second third other another)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:03
S39	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) and (first second third other another)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:03
S40	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:04
S41	0	(first second third one) near3 layer near3 conduct\$3 near3 layers near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:07
S42	0	(first second third one) near3 layer near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:07
S43	0	(first second third one) near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:07
S44	0	(first second third one) near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivy	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:08
S45	0	conduct\$3 near3 layer\$1 near3 electrical near2 resistivy	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:08
S46	206,361	second near2 conductive layer near3 electrical near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:09

S47	0	second near2 conductive near3 layer near3 electrical near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:09
S48	0	second near2 conductive near3 layer near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:10
S49	21	second near2 conductive near3 layer same electrical near3 resistivity same less	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:11
S50	7	middle near2 conductive near3 layer near3 (thicker)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:34
S51	22	(middle mid center centre) near2 conductive near3 (layer section part) near3 (thicker wider fatter)	US-PGPUB; USPAT	OR	OFF	2018/09/06 13:56
S52	35,893	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2018/09/06 13:56
S53	0	S51 and S52	US-PGPUB; USPAT	OR	OFF	2018/09/06 13:56
S55	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:29
S56	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:29
S57	1	"6504202".pn.	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:29
S58	1	"20160103549".pn.	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:32
S59	0	first same third same conduct\$3 same layer same titanium	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:34
S60	5,389	first same third same conduct\$3 same layer same titanium	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:34
S61	35,893	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:35
S62	4,524	first same third same conduct\$3 same layer same titanium and aluminum	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:35

S63	3,038	first same third same conduct\$3 same layer same titanium same aluminum	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:35
S64	122	S61 and S63	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:36
S65	1,108	first near2 conduct\$3 same second near2 conduct\$3 same third near2 conduct\$3 same layer same Titanium same Aluminum	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:42
S66	28	S61 and S65	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:43
S67	1,153	aluminum near2 layer same (between sorrounded) near3 Titanium	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:50
S68	641	aluminum near2 layer same (between sorrounded) near3 Titanium near2 layer	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:50
S69	66	S61 and S68	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:51
S70	183	towfiq near elahi	US-PGPUB; USPAT	OR	OFF	2018/09/07 10:31
S71	2	"20140320769"	US-PGPUB; USPAT	OR	OFF	2018/09/07 10:36
S72	1	"20170076502"	US-PGPUB; USPAT	OR	OFF	2018/09/07 12:39
S73	1	"20180095581"	US-PGPUB; USPAT	OR	OFF	2018/09/10 09:54
S74	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/27 15:40
S75	204	towfiq near2 elahi	US-PGPUB; USPAT	OR	OFF	2019/02/27 15:47
S76	5	("20100060602" "20110102370" "20120118614" "20120212449" "20120312677").PN. OR ("9323370").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/02/27 16:04
S77	75	"20060097991"	US-PGPUB;	OR	OFF	2019/02/27 16:06

			USPAT; USOCR			
S78	1	"15660827" and (thickness near3 second near2 connection part\$1)	US-PGPUB; USPAT	OR	OFF	2019/02/28 08:51
S79	0	"15660827" and (thickness near3 second near2 connection near2 part\$1)	US-PGPUB; USPAT	OR	OFF	2019/02/28 08:52
S80	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/28 14:48
S81	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2019/02/28 14:58
S82	2	"20140320769"	US-PGPUB; USPAT	OR	OFF	2019/02/28 15:21
S83	1	"15660827"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S84	14	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S85	0	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern same touch	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S86	0	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern and touch	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S87	15	insula\$3 near2 pattern near3 between same first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S88	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S89	2	"20160103549"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S90	1	"20160147335"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S91	2	"20170336907"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S92	2	"20140160066"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S93	0	((("AN") near3 ("Chiwook"))).INV.	USPAT	OR	OFF	2019/02/28 17:00
S94	12	((("KIM") near3 ("Doyeon"))).INV.	US-PGPUB	OR	OFF	2019/02/28 17:00
S95	10	((("PARK") near3 ("Sunghyun"))).INV.	USPAT	OR	OFF	2019/02/28 17:00
S96	22	((("LEE") near3 ("Jaehyun"))).INV.	USPAT	OR	OFF	2019/02/28 17:00
S97	0	((("CHO") near3 ("Sung-woong"))).INV.	USPAT	OR	OFF	2019/02/28 17:00
S98	0	((("CHO") near3 ("Sung-woong"))).INV.	USPAT	OR	OFF	2019/02/28 17:00
S99	4	insula\$3 near2 pattern near3 between same first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern and display	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S100	0	touch near3 (sens\$3 detect\$3) near3 on near3 display near3 (part section substrate)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S101	222	touch near3 (sens\$3 detect\$3) near3 display near3 (part section substrate) same insulat\$3	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S102	39,064	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S103	193	S101 and S102	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S104	1	"20160147335"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S105	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S106	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S107	2	"20160103549"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S108	0	(first second third) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third) near3 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S109	0	(first second third one) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third) near3 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S110	0	(first second third one) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third other another) near3 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S111	0	conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third other another) near3 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S112	0	conductive near3 layer near3 resistivi near3 (less lower different) near3 (first second third other another) near3 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S113	1,162,602	(first second third other another) near3 layer conductive near3 layers near3 resistivi near3 (less lower different)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S114	39,064	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S115	17,063	S113 and S114	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S116	1,162,583	(first second third) near3 layer conductive near3 layers near3 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S117	17,063	S114 and S116	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S118	1,612,494	(first second third one) near3 layer conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same than near3 (first second third other another)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S119	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same than near3 (first second third other another)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S120	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

		lower different) same (first second third other another)				
S121	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) and (first second third other another)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S122	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S123	0	(first second third one) near3 layer near3 conduct\$3 near3 layers near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S124	0	(first second third one) near3 layer near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S125	0	(first second third one) near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S126	0	(first second third one) near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S127	0	conduct\$3 near3 layer\$1 near3 electrical near2 resistivi	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S128	214,000	second near2 conductive layer near3 electrical near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S129	0	second near2 conductive near3 layer near3 electrical near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S130	0	second near2 conductive near3 layer near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S131	22	second near2 conductive near3 layer same electrical near3 resistivity same less	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S132	8	middle near2 conductive near3 layer near3 (thicker)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S133	23	(middle mid center centre) near2 conductive near3 (layer section part) near3 (thicker wider fatter)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S134	39,064	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S135	0	S133 and S134	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S136	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S137	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S138	1	"6504202".pn.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S139	1	"20160103549".pn.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S140	0	first same third same conduct\$3 same layer same titanium	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S141	5,648	first same third same conduct\$3 same layer same titanium	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S142	39,064	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S143	4,756	first same third same conduct\$3 same layer same titanium and aluminum	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S144	3,209	first same third same conduct\$3 same layer same titanium same aluminum	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S145	145	S142 and S144	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S146	1,129	first near2 conduct\$3 same second near2 conduct\$3 same third near2 conduct\$3 same layer same Titanium same Aluminum	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S147	33	S142 and S146	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S148	1,191	aluminum near2 layer same (between sorrounded) near3 Titanium	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S149	667	aluminum near2 layer same (between sorrounded) near3 Titanium near2 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S150	73	S142 and S149	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S151	204	towfiq near elahi	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S152	2	"20140320769"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S153	1	"20170076502"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S154	1	"20180095581"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S155	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S156	204	towfiq near2 elahi	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S157	5	("20100060602" "20110102370" "20120118614" "20120212449" "20120312677").PN. OR ("9323370").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/02/28 17:00
S158	75	"20060097991"	US-PGPUB; USPAT; USOCR	OR	OFF	2019/02/28 17:00
S159	1	"15660827" and (thickness near3 second near2 connection part\$1)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S160	0	"15660827" and (thickness near3 second near2 connection near2 part\$1)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S161	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S162	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S163	2	"20140320769"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S164	0	second near3 conductive near3 pattern near4 thickness near4 (greater bigger (more adj than)) near3 thickness near3 second near3 connection near3 part	US-PGPUB; USPAT	OR	OFF	2019/05/09 11:00
S165	0	conductive near3 pattern near4 thickness near4 (greater bigger (more adj than)) near3 thickness near3 connection near3 part	US-PGPUB; USPAT	OR	OFF	2019/05/09 11:04
S166	263	second near3 conductive near3 pattern near4 thickness near4 (greater bigger (more adj than)) samr thickness near3 second near3 connection near3 part	US-PGPUB; USPAT	OR	OFF	2019/05/09 11:05
S167	1,006	second near3 conduct\$3 near3 pattern near4 (thickness width) near4 (greater bigger (more adj than)) samr (thickness width) near3 second near3 connect\$3 near3 (part section)	US-PGPUB; USPAT	OR	OFF	2019/05/09 11:10
S168	0	second near3 conduct\$3 near3 pattern near4 (thickness width) near4 (greater bigger (more adj than)) same (thickness width) near3 second near3 connect\$3 near3 (part section)	US-PGPUB; USPAT	OR	OFF	2019/05/09 11:10
S169	1	"16742230"	US-PGPUB; USPAT	OR	OFF	2020/07/29 10:30
S170	1	"10541279" .pn.	US-PGPUB; USPAT	OR	OFF	2020/07/29 10:31
S171	7	buffer near2 layer near2 directly near3 encapsulation near layer	US-PGPUB; USPAT	OR	OFF	2020/07/29 11:49
S172	3	buffer near2 directly near3 encapsulation near layer	US-PGPUB; USPAT	OR	OFF	2020/07/29 11:54
S173	5	buffer near2 directly near3 encapsulation	US-PGPUB; USPAT	OR	OFF	2020/07/29 11:54
S174	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:13
S175	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:14
S176	2	"20140320769"	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:15

S177	2	"20160103549"	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:20
S178	0	buffer same encapsulation same conductive near2 pattewrn	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:28
S179	0	buffer same encapsulation same conductive near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:28
S180	0	buffer same encapsulation same (conductive metal) near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:28
S181	0	buffer near2 layer and encapsulation near2 layer and (conductive metal) near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:29
S182	2	"20180166507"	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:57
S183	11	("20090058250" "20100265206" "20140049522" "20150049263" "20150091849" "20150153881" "20150355771" "20160179264" "20170083140" "20170277296" "20170321087").PN. OR ("10720474").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/07/29 16:02
S184	286	buffer near2 layer near3 encapsulation near layer	US-PGPUB; USPAT	OR	OFF	2020/07/29 16:12
S185	49,085	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2020/07/29 16:13
S186	135	S184 and S185	US-PGPUB; USPAT	OR	OFF	2020/07/29 16:13
S187	3,004,158	S184 and S185 and conductive neae2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 16:13
S188	12	S184 and S185 and conductive near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 16:14
S189	35	("10268238" "20080277259" "20100182250" "20110285661" "20130002569" "20130147727" "20130278513" "20140028599" "20140078108" "20140078692" "20140217373" "20140217382" "20140217397" "20140232956"	US-PGPUB; USPAT; USOCR	OR	OFF	2020/07/29 16:17

		"20140256070" "20150193058" "20160093685" "20160306472" "20160315284" "7864503" "7920129" "8274488" "8358284" "8461760" "8698768" "8730191" "8946690" "9001079" "9035907" "9046952" "9128569" "9239654" "9335881" "9515131" "RE44866").PN. OR ("10707280").URPN.				
S190	0	buffer near2 layer and encapsulation near2 layer and (conductive metal touch sensor detector) near2 pattern	US- PGPUB; USPAT	OR	OFF	2020/07/29 17:19
S191	0	buffer near2 layer and encapsulation near2 layer and (conductive metal touch sensor or detector) near2 pattern	US- PGPUB; USPAT	OR	OFF	2020/07/29 17:19
S192	0	buffer near2 layer and encapsulation near2 layer and (conductive metal touch sensor or detector)	US- PGPUB; USPAT	OR	OFF	2020/07/29 17:20
S193	2	insulation near2 layer near3 encapsulation near layer same conductive near2 pattern	US- PGPUB; USPAT	OR	OFF	2020/07/30 09:22
S194	26	insulation near2 layer near3 encapsulation near layer and conductive near2 pattern	US- PGPUB; USPAT	OR	OFF	2020/07/30 09:24
S195	1	"16742230"	US- PGPUB; USPAT	OR	OFF	2020/07/30 11:35

EAST Search History (Interference)

<This search history is empty>

7/30/2020 5:42:11 PM

C:\Users\telahi\Documents\EAST\Workspaces\16742230_Con_15660827.wsp

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)	Attorney Docket Number	183539
	Application Number	16/742,230
	Filing Date	January 14, 2020
	Inventor(s)	Chiwook An, et al.
	Group Art Unit	2621
	Examiner Name	AWAD, AMR A

U.S. PATENT DOCUMENTS				
EXAMINER INITIALS	Cite No. ¹	DOCUMENT NUMBER Number - Kind Code ² (If Known)	PUBLICATION DATE OR ISSUE DATE MM-DD-YYYY	NAME OF PATENTEE
		2010/0110023 A1	05-06-2010	Chien et al.
		2011/0193793 A1	08-11-2011	An et al.
		2015/0085205 A1	03-26-2015	Chen et al.

FOREIGN PATENT DOCUMENTS					
EXAMINER INITIALS	Cite No. ¹	Foreign Patent Document Country Code ³ - Number ⁴ - Kind Code ⁵ (If Known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T ⁶ (✓)

OTHER DOCUMENTS		
EXAMINER INITIALS	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.

EXAMINER SIGNATURE	/TOWFIQ ELAHI/	DATE CONSIDERED	07/30/2020
EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. ³ Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English Language Translation is attached.			

JEJ/frs

Sheet 1 of 1

111801939.1

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/742,230		Filing Date 01/14/2020		☐ To be Mailed					
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO													
APPLICATION AS FILED - PART I													
		(Column 1)	(Column 2)										
FOR		NUMBER FILED	NUMBER EXTRA		RATE (\$)		FEE (\$)						
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A		N/A								
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))		N/A	N/A		N/A								
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A		N/A								
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =	*		x \$100 =								
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =	*		x \$460 =								
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).											
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))													
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL							
APPLICATION AS AMENDED - PART II													
		(Column 1)	(Column 2)		(Column 3)								
AMENDMENT	02/16/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)				
	Total (37 CFR 1.16(i))	* 16	Minus	** 20	= 0		x \$100 =		0				
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x \$480 =		0				
	☐ Application Size Fee (37 CFR 1.16(s))												
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))												
								TOTAL ADD'L FEE		0			
AMENDMENT		(Column 1)	(Column 2)		(Column 3)								
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)				
	Total (37 CFR 1.16(i))	*	Minus	**	=		x \$0 =						
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x \$0 =						
	☐ Application Size Fee (37 CFR 1.16(s))												
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))													
								TOTAL ADD'L FEE					
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.								LIE					
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".								/MONICA D FRANCIS/					
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".													
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.													

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on February 16, 2021 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.

/Sheila R. Harter/
Sheila R. Harter

Appl No. : 16/742,230
Inventor : Chiwook An, et al.
Filed : January 14, 2020
Title : DISPLAY DEVICE

Confirmation No. 7917

TC/A.U. : 2625
Examiner : Towfiq Elahi

Docket No. : 183539
Customer No. : 23363

AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
February 16, 2021

Commissioner:

This paper is in response to the Office action of November 17, 2020, which set an initial period for reply to expire on February 17, 2021. Any extension of time fee required by this paper is paid concurrently herewith. As such, this response is timely filed. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

Electronic Acknowledgement Receipt	
EFS ID:	41933595
Application Number:	16742230
International Application Number:	
Confirmation Number:	7917
Title of Invention:	DISPLAY DEVICE
First Named Inventor/Applicant Name:	Chiwook AN
Customer Number:	23363
Filer:	Ryan Matthew Swank/Sheila Harter
Filer Authorized By:	Ryan Matthew Swank
Attorney Docket Number:	183539/411598-04552
Receipt Date:	16-FEB-2021
Filing Date:	14-JAN-2020
Time Stamp:	15:16:34
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		183539Amendment.pdf	134819	yes	10
			09b105cfc4d885f1e61baa89eaf30c6b2e35fa3c		

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Applicant Arguments/Remarks Made in an Amendment	6	10
	Claims	2	5
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Warnings:			
Information:			
Total Files Size (in bytes):		134819	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>			

Appln No. 16/742,230
Amdt date February 16, 2021
Reply to Office action of November 17, 2020

REMARKS/ARGUMENTS

Claims 1-16 are pending in the instant application, of which claims 1 and 6 are independent. Claims 1 and 6 are amended herein. No new matter is added. In view of the amendments and remarks that follow, Applicant respectfully requests allowance of claims 1-16.

1. **Non-Statutory Double Patenting Rejection**

Claim 1

Claim 1 rejected on the ground of non-statutory double patenting as being unpatentable over claim 1 and claim 4 of US 10541279 in view of Kwon (US 20140232956).

Because the final claim scope of the claims in the present application has not been determined, Applicant reserves the right to file a future terminal disclaimer or to argue that the claims of the present application are ultimately patentably distinct over the claims of U.S. Patent No. 10,541,279 in view of Kwon (US 2014/0232956).

2. **Claims Rejection Under 35 U.S.C. § 112**

Claim 1

Claim 1 rejected under 35 U.S.C. 112(a) as allegedly failing to comply with the written description requirement.

Paragraph [00105] of the present application as originally filed states, in relevant part, "[a]n inorganic layer may be located on the thin film encapsulation layer TFE, and the touch sensing unit TS may be located on the inorganic layer. The inorganic layer may be a buffer layer."

Accordingly, Applicant submits that the claim 1 features of "a buffer layer directly on the thin film encapsulation layer" and "a touch sensing unit directly on the buffer layer" are fully supported by the Application as originally filed, and requests that the rejections under 35 U.S.C. § 112 be withdrawn.

3. **Claim Rejections Under 35 U.S.C. § 103**

Claims 1-5, 7 and 14-16

Claim 1-5, 14-15 are rejected under 35 U.S.C. 103 as allegedly being unpatentable over Zhu (US 20160313837) in view of Kwon (US 20140232956) and Allman (US 6504202).

Claim 7 is rejected under 35 U.S.C. 103 as allegedly being unpatentable over Zhu (US 20160313837) in view of Kwon (US 20140232956) and Allman (US 6504202) and further in view of Sonoda (US 20170176803).

Claim 16 is rejected under 35 U.S.C. 103 as allegedly being unpatentable over Zhu (US 20160313837) in view of Kwon (US 20140232956) and Allman (US 6504202) and further in view of Lee (US 20160103549).

In rejecting claim 1, page 8 of the Office action states that Allman allegedly teaches “the second conductive pattern having a thickness that is greater than a thickness of the first conductive pattern (Fig. 5, shows second metal layer 38 thicker than first conductive layer 34 and third conductive layer 40).”

With respect to the 103 rejections of the claims, to establish a *prima facie* case of obviousness, there should be provided some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness demonstrating why one of ordinary skill in the art prior to the effective filing date of the present application would have combined the disclosures of these references to arrive at the claimed embodiment. Furthermore, there should be some explanation why any differences between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art.

Allman discloses “[a] metal-insulator-metal capacitor [that] is embedded in an interconnect layer of an integrated circuit (IC)” (see Abstract). That is, the alleged second conductive pattern/second metal layer 38 and the alleged first conductive pattern/first conductive layer 34/third conductive layer 40 correspond to *neither* a “display device” *nor*

Appln No. 16/742,230
Amdt date February 16, 2021
Reply to Office action of November 17, 2020

a “touch sensing unit,” as recited in claim 1. In fact, Allman does not appear to disclose or otherwise refer to a display device or a touch sensing unit whatsoever.

Moreover, col. 6, Ins. 29-30 of Allman states “[t]he aluminum layer 38 is formed on top of the titanium nitride layer 36.” Accordingly, Allman does not appear to disclose that the alleged second conductive pattern/second metal layer 38 is “*electrically insulated* from the first conductive pattern”/the first conductive layer 34/the third conductive layer 40, as recited in claim 1.

Further still, Allman does not appear to disclose that the alleged second conductive pattern/second metal layer 38 is “*partially* crossing the first conductive pattern”/the first conductive layer 34/the third conductive layer 40, as recited in claim 1.

Finally, the alleged first and second conductive patterns of Allman do not appear to have any relevant nexus to the alleged first and second conductive patterns of Zhu *other than* the fact that they each compose a metal. Although page 9 of the Office action states “[t]he motivation is simple substitution of known element to yield predictable results,” Applicant submits that the respective devices of Allman and Zhu are so different that the respective first and second conductive patterns could *not* be merely substituted for one another.

Given the above, Applicant submits that the disclosure of Allman is irrelevant to the features of claim 1 of the present application. That is, one of ordinary skill in the art at the effective filing date of the present application would have no conceivable reason to modify Zhu in the manner proposed in the Office action in view of the disclosure of Allman.

Accordingly, it appears that the references, whether taken alone or in combination, fail to disclose the features now recited in amended claim 1. Applicant, therefore, respectfully submits that there is no apparent reason why one of ordinary skill in the art prior to the effective filing date of the present application would have combined the disclosures of the cited references to arrive at the claimed embodiment of claim 1, and that this claim would not have been obvious over the art of record to one skilled in the art at the time prior to the effective filing date of the present application.

Appln No. 16/742,230
Amdt date February 16, 2021
Reply to Office action of November 17, 2020

Furthermore, because claims 2-5 and 14-16 depend from claim 1, they each incorporate all of the terms and features of their base claim, in addition to other features, which together further patentably distinguish these claims over the art of record when considered as a whole. Therefore, Applicant requests that the rejections of these claims also be withdrawn, and that these claims be allowed as well.

4. **Allowable Subject Matter**

Claims 6 and 8-13

Applicant wishes to thank the Examiner for indicating that claims 6 and 8-13 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicant has rewritten claim 6 to be in independent and to substantially incorporate all of the features of original claim 1. Accordingly, and because claims 7-13 depend from claim 6, claims 6-13 are believed to be in condition for allowance.

5. **Concluding Remarks**

In view of the foregoing amendments and remarks, Applicant earnestly solicits a timely issuance of a Notice of Allowance with claims 1-16. If there are any remaining issues that can be addressed over the telephone, the Examiner is cordially invited to call Applicant's attorney at the number listed below.

Appln No. 16/742,230
Amdt date February 16, 2021
Reply to Office action of November 17, 2020

Payment of any fee required to enter and process this response is provided. The Director is authorized to charge any underpayment of fees or credit any overpayment of fees to Deposit Account No. 03-1728.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By /Ryan M. Swank/
Ryan M. Swank
Reg. No. 62,600
626/795-9900

Appln No. 16/742,230
Amdt date February 16, 2021
Reply to Office action of November 17, 2020

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A display device comprising:
 - an organic light emitting device layer;
 - a thin film encapsulation layer on the organic light emitting device layer;
 - a buffer layer directly on the thin film encapsulation layer; and
 - a touch sensing unit directly on the buffer layer, the touch sensing unit comprising:
 - a first conductive pattern on the buffer layer;
 - an insulating layer covering the first conductive pattern; and
 - a second conductive pattern on the insulating layer, the second conductive pattern partially crossing the first conductive pattern, being electrically insulated from the first conductive pattern, and having a thickness that is greater than a thickness of the first conductive pattern.
2. (Original) The display apparatus of claim 1, wherein the first conductive pattern is directly on the buffer layer.
3. (Original) The display apparatus of claim 1, wherein the buffer layer comprises at least one of a silicon nitride, a silicon-oxy-nitride, and a silicon oxide.
4. (Original) The display apparatus of claim 1, wherein the thin film encapsulation layer comprises:
 - a first inorganic layer;
 - an organic layer on the first inorganic layer; and

a second inorganic layer on the organic layer.

5. (Original) The display apparatus of claim 4, wherein the buffer layer is directly on the second inorganic layer.

6. (Currently Amended) ~~The display apparatus of claim 1, wherein the first conductive pattern comprises:~~ A display device comprising:

an organic light emitting device layer;

a thin film encapsulation layer on the organic light emitting device layer;

a buffer layer directly on the thin film encapsulation layer; and

a touch sensing unit directly on the buffer layer, the touch sensing unit comprising:

a first conductive pattern on the buffer layer, and comprising:

a first conductive layer on the buffer layer;

a second conductive layer on the first conductive layer; and

a third conductive layer on the second conductive layer;

an insulating layer covering the first conductive pattern; and

a second conductive pattern on the insulating layer, the second conductive pattern partially crossing the first conductive pattern, and having a thickness that is greater than a thickness of the first conductive pattern, and comprising:—, and wherein the second conductive pattern comprises:

a fourth conductive layer on the insulating layer;

a fifth conductive layer on the fourth conductive layer; and

a sixth conductive layer on the fifth conductive layer.

7. (Original) The display apparatus of claim 6, wherein each of the second conductive layer and the fifth conductive layer comprises aluminum (Al), and

wherein each of the first conductive layer, the third conductive layer, the fourth conductive layer and the sixth conductive layer comprises titanium (Ti).

8. (Original) The display apparatus of claim 6, wherein a thickness of the second conductive layer is greater than each of a thickness of the first conductive layer and a thickness of the third conductive layer.

9. (Original) The display apparatus of claim 6, wherein a thickness of the fifth conductive layer is greater than each of a thickness of the fifth conductive layer and a thickness of the sixth conductive layer.

10. (Original) The display apparatus of claim 6, wherein a thickness of the second conductive layer is less than a thickness of the fifth conductive layer.

11. (Original) The display apparatus of claim 6, wherein a thickness difference between the second conductive layer and the first conductive layer is greater than a thickness difference between the third conductive layer and the first conductive layer.

12. (Original) The display apparatus of claim 6, wherein a thickness difference between the fifth conductive layer and the fourth conductive layer is greater than a thickness difference between the sixth conductive layer and the fourth conductive layer.

13. (Original) The display apparatus of claim 6, wherein a thickness difference between the fifth conductive layer and the fourth conductive layer is greater than a thickness difference between the second conductive layer and the first conductive layer.

Appln No. 16/742,230
Amdt date February 16, 2021
Reply to Office action of November 17, 2020

14. (Original) The display apparatus of claim 1, wherein the second conductive pattern comprises:
first touch sensor parts;
second touch sensor parts spaced from the first touch sensor parts; and
first connection parts connecting respective ones of the first touch sensor parts,
wherein the first conductive pattern comprises electrically conductive second connection parts connecting respective ones of the second touch sensor parts.

15. (Original) The display apparatus of claim 14, wherein the second connection parts are directly on the buffer layer.

16. (Original) The display apparatus of claim 1, wherein a thickness of the insulating layer is less than a thickness of the second conductive pattern.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/742,230	01/14/2020	Chiwook AN	183539/411598-04552	7917
23363	7590	04/19/2021	EXAMINER	
Lewis Roca Rothgerber Christie LLP			ELAHI, TOWFIQ	
PO BOX 29001				
Glendale, CA 91209-9001				
			ART UNIT	PAPER NUMBER
			2625	
			NOTIFICATION DATE	DELIVERY MODE
			04/19/2021	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PLPrivatePair@lrrc.com
pto@lewisroca.com

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit <http://www.uspto.gov/forms/>. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to <http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp>.

2. Claim 1 rejected on the ground of nonstatutory double patenting as being unpatentable over claim 1 and claim 4 of US 10541279 in view of Kwon (US 20140232956). Although the claims at issue are not identical, they are not patentably distinct from each other.

Claim 1 of this Application	US 10541279
-----------------------------	-------------

<p>1. A display device comprising: an organic light emitting device layer; a thin film encapsulation layer on the organic light emitting device layer; a buffer layer directly on the thin film encapsulation layer; and a touch sensing unit directly on the buffer layer, the touch sensing unit comprising:</p> <p>a first conductive pattern on the buffer layer; an insulating layer covering the first conductive pattern; and a second conductive pattern on the insulating layer, the second conductive pattern partially crossing the first conductive pattern, and</p> <p>having a thickness that is greater than a thickness of the first conductive pattern.</p>	<p>1. A display device comprising: a display panel; and</p> <p>a touch sensing unit on the display panel, the touch sensing unit comprising:</p> <p>a first conductive pattern on the display panel; an insulating layer covering the first conductive pattern; and a second conductive pattern on the insulating layer, partially crossing the first conductive pattern, and</p> <p>comprising: first touch sensor parts; second touch sensor parts spaced from the first touch sensor parts; and first connection parts connecting respective ones of the first touch sensor parts, wherein the first conductive pattern comprises electrically conductive second connection parts connecting respective ones of the second touch sensor parts, and wherein the second conductive pattern has a thickness that is greater than a thickness of the second connection parts.</p> <p>4. The display device of claim 1, wherein the thickness of the first conductive pattern is equal to or greater than about 1800 angstroms, and equal to or less than about 2100 angstroms, and wherein the thickness of the second conductive pattern is equal to or greater than about 2700 angstroms, and equal to or less than about 3500 angstroms.</p>
--	--

	<p>19. The display device of claim 1, wherein the display panel comprises: a base layer; a circuit layer on the base layer; an organic light emitting device layer on the circuit layer; and a thin film encapsulation layer on the organic light emitting device layer.</p>
--	--

US 10541279 do not expressly disclose a buffer layer directly on the thin film encapsulation layer.

But in similar art Kwon disclosed a buffer layer (fig. 1E, item 181) directly on the thin film encapsulation layer (fig. 1, item 188)

At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine current application with Kwon teaching so that it may include a buffer layer directly on the thin film encapsulation layer.

The motivation is simple substitution of known element to yield predictable results.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 1-5, 14-15 is/are rejected under 35 U.S.C. 103 as being unpatentable over Zhu (US 20160313837) in view of Kwon (US 20140232956) and Kim (US 20150185911).

Regarding **claim 1** Zhu disclosed a display device (fig.1) comprising:

an organic light emitting device layer (fig. 1, item 104);

a thin film encapsulation layer (fig. 1, item 106) on the organic light emitting device layer;

a touch sensing unit (fig. 1, items comprising 105 and 107) directly on the buffer layer (fig. 1, item 102), the touch sensing unit comprising:

a first conductive pattern (fig. 1, item 105) on the buffer layer (fig. 1, item 106);

an insulating layer covering the first conductive pattern ([0074] As being different from

Embodiment 1, in the present embodiment, separating pillars 109 adapted for separating the second electrodes are configured on the substrate 101, so as to rendering the first conductive units 105 insulated from one another); and

a second conductive pattern on the insulating layer (fig. 1, ABSTRACT: the second conductive units (107) are configured to be insulated from each other),

the second conductive pattern partially crossing the first conductive pattern (fig.2-3, item 105 and 107 partially crossing).

Zhu does not expressly teach a buffer layer directly on the thin film encapsulation layer; and the second conductive pattern having a thickness that is greater than a thickness of the first conductive pattern.

However Kwon teach a buffer layer (fig. 1E, item 181) directly on the thin film encapsulation layer (fig. 1E, item 188).

Therefore it would have been obvious to one of the ordinary skilled in the art before effective filing date to combine Zhu in light of Kwon so that it may include a buffer layer directly on the thin film encapsulation layer.

The motivation is simple substitution of known element to yield predictable results.

Zhu does not expressly teach the second conductive pattern partially crossing the first conductive pattern, being electrically insulated from the first conductive pattern, and having a thickness that is greater than a thickness of the first conductive pattern.

However Kim teach the second conductive pattern (fig. 3, second conductive pattern 132) partially crossing the first conductive pattern (fig. 3, first conductive pattern 131), being electrically insulated from the first conductive pattern, and having a thickness that is greater than a thickness of the first conductive pattern (fig. 3 see below for thickness in red and purple).

Regarding **claim 3** Zhu disclosed wherein the buffer layer comprises at least one of a silicon nitride, a silicon-oxy-nitride, and a silicon oxide ([0056]).

Regarding **claim 4** Zhu disclosed wherein the thin film encapsulation layer comprises: a first inorganic layer; an organic layer on the first inorganic layer; and a second inorganic layer on the organic layer ([0056] Both of the first encapsulation layer 106 and the second encapsulation layer 108 comprise a single layer of or multiple alternately arranged layers of organic films and/or inorganic films. The inorganic film is selected from but not limited to silicon nitride film, silicon oxide film. The organic film is selected from but not limited to ultraviolet ray curable resin film, silicon dioxide--acrylic resin composite material film).

Regarding **claim 5** Zhu disclosed wherein the buffer layer is directly on the second inorganic layer.

Regarding **claim 14** Zhu disclosed wherein the second conductive pattern comprises: first touch sensor parts; second touch sensor parts spaced from the first touch sensor parts (fig1, item 105, 107 spaced from each other); and first connection parts connecting respective ones of the first touch sensor parts, wherein the first conductive pattern comprises electrically conductive second connection parts connecting respective ones of the second touch sensor parts (fig. 2).

Regarding **claim 15** Zhu disclosed wherein the second connection parts (fig. 1, item 107) are directly on the buffer layer (fig. 1, item 106).

Claim 16 is/are rejected under 35 U.S.C. 103 as being unpatentable over Zhu (US 20160313837) in view of Kwon (US 20140232956) and Kim (US 20150185911) and further in view of Lee (US 20160103549).

Regarding **claim 16** Zhu does not expressly teach thickness of the insulating layer is less than a thickness of the second conductive pattern.

However Lee teach thickness of the insulating layer (fig. 4C insulating layer 421) is less than a thickness of the second conductive pattern (fig. 4C, item 410).

Therefore it would have been obvious to one of the ordinary skilled in the art before effective filing date to combine Zhu in light of Lee so that it may include thickness of the insulating layer is less than a thickness of the second conductive pattern.

The motivation is simple substitution of known element to yield predictable results.

Allowable Subject Matter

Claims 6-13 allowed.

Response to Arguments

Applicant's arguments with respect to claim(s) 1 have been considered but are moot because the new ground of rejection does not rely on any the new reference applied in the prior rejection of record for any teaching or matter specifically challenged in the argument.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Junta US 20180261660.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TOWFIQ ELAHI whose telephone number is (571)270-1687. The examiner can normally be reached on M-F: 10AM-3PM.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William Boddie can be reached on (571)272-0666. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <https://ppair-my.uspto.gov/pair/PrivatePair>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/TOWFIQ ELAHI/
Primary Examiner, Art Unit 2625

Notice of References Cited	Application/Control No. 16/742,230	Applicant(s)/Patent Under Reexamination AN et al.	
	Examiner TOWFIQ ELAHI	Art Unit 2625	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20180261660-A1	09-2018	Jinta; Seiichiro	H01L27/127	1/1
*	B	US-20150185911-A1	07-2015	KIM; Dae Won	H03K17/9622	349/12
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

U.S. Patent and Trademark Office
PTO-892 (Rev. 01-2001)

Notice of References Cited

Part of Paper No. 20210414

<i>Search Notes</i> 	Application/Control No. 16/742,230	Applicant(s)/Patent Under Reexamination AN et al.
	Examiner TOWFIQ ELAHI	Art Unit 2625

CPC - Searched*		
Symbol	Date	Examiner
H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256	07/30/2020	TE

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
Text searched in EAST	07/30/2020	TE
Updated search in EAST	04/14/2021	TE

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

--	--

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	"15660827"	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:03
S2	13	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:06
S3	0	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern same touch	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:06
S4	0	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern and touch	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:07
S5	14	insula\$3 near2 pattern near3 between same first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:09
S6	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:10
S7	2	"20160103549"	US-PGPUB; USPAT	OR	OFF	2018/09/04 14:22
S8	1	"20160147335"	US-PGPUB; USPAT	OR	OFF	2018/09/04 15:02
S9	1	"20170336907"	US-PGPUB; USPAT	OR	OFF	2018/09/04 15:05
S10	2	"20140160066"	US-PGPUB; USPAT	OR	OFF	2018/09/04 15:14
S11	0	((("AN") near3 ("Chiwook"))).INV.	USPAT	OR	OFF	2018/09/04 15:18
S12	12	((("KIM") near3 ("Doyeon"))).INV.	US-PGPUB	OR	OFF	2018/09/04 15:18
S13	8	((("PARK") near3 ("Sunghyun"))).INV.	USPAT	OR	OFF	2018/09/04 15:19

S14	21	((("LEE") near3 ("Jaehyun"))).INV.	USPAT	OR	OFF	2018/09/04 15:19
S15	0	((("CHO") near3 ("Sung-woong"))).INV.	USPAT	OR	OFF	2018/09/04 15:19
S16	0	((("CHO") near3 ("Sung-woong"))).INV.	USPAT	OR	OFF	2018/09/04 15:20
S17	4	insula\$3 near2 pattern near3 between same first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern and display	US- PGPUB; USPAT	OR	OFF	2018/09/05 10:04
S18	0	touch near3 (sens\$3 detect\$3) near3 on near3 display near3 (part section substrate)	US- PGPUB; USPAT	OR	OFF	2018/09/05 10:06
S19	196	touch near3 (sens\$3 detect\$3) near3 display near3 (part section substrate) same insulat\$3	US- PGPUB; USPAT	OR	OFF	2018/09/05 10:07
S20	35,861	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US- PGPUB; USPAT	OR	OFF	2018/09/05 10:09
S21	170	S19 and S20	US- PGPUB; USPAT	OR	OFF	2018/09/05 10:10
S22	1	"20160147335"	US- PGPUB; USPAT	OR	OFF	2018/09/05 13:37
S23	2	"20100182273"	US- PGPUB; USPAT	OR	OFF	2018/09/06 08:59
S24	2	"20160041644"	US- PGPUB; USPAT	OR	OFF	2018/09/06 08:59
S25	2	"20160103549"	US- PGPUB; USPAT	OR	OFF	2018/09/06 08:59
S26	0	(first second third) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third) near3 layer	US- PGPUB; USPAT	OR	OFF	2018/09/06 09:55
S27	0	(first second third one) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third) near3 layer	US- PGPUB; USPAT	OR	OFF	2018/09/06 09:56
S28	0	(first second third one) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third other another) near3 layer	US- PGPUB; USPAT	OR	OFF	2018/09/06 09:57

S29	0	conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third other another) near3 layer	US- PGPUB; USPAT	OR	OFF	2018/09/06 09:57
S30	0	conductive near3 layer near3 resistivi near3 (less lower different) near3 (first second third other another) near3 layer	US- PGPUB; USPAT	OR	OFF	2018/09/06 09:57
S31	1,122,191	(first second third other another) near3 layer conductive near3 layers near3 resistivi near3 (less lower different)	US- PGPUB; USPAT	OR	OFF	2018/09/06 09:58
S32	35,893	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US- PGPUB; USPAT	OR	OFF	2018/09/06 09:59
S33	15,461	S31 and S32	US- PGPUB; USPAT	OR	OFF	2018/09/06 09:59
S34	1,122,172	(first second third) near3 layer conductive near3 layers near3 resistivi near3 (less lower different more)	US- PGPUB; USPAT	OR	OFF	2018/09/06 10:00
S35	15,461	S32 and S34	US- PGPUB; USPAT	OR	OFF	2018/09/06 10:00
S36	1,556,030	(first second third one) near3 layer conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same than near3 (first second third other another)	US- PGPUB; USPAT	OR	OFF	2018/09/06 10:02
S37	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same than near3 (first second third other another)	US- PGPUB; USPAT	OR	OFF	2018/09/06 10:03
S38	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same (first second third other another)	US- PGPUB; USPAT	OR	OFF	2018/09/06 10:03
S39	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) and (first second third other another)	US- PGPUB; USPAT	OR	OFF	2018/09/06 10:03
S40	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different more)	US- PGPUB; USPAT	OR	OFF	2018/09/06 10:04

S41	0	(first second third one) near3 layer near3 conduct\$3 near3 layers near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:07
S42	0	(first second third one) near3 layer near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:07
S43	0	(first second third one) near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:07
S44	0	(first second third one) near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:08
S45	0	conduct\$3 near3 layer\$1 near3 electrical near2 resistivi	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:08
S46	206,361	second near2 conductive layer near3 electrical near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:09
S47	0	second near2 conductive near3 layer near3 electrical near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:09
S48	0	second near2 conductive near3 layer near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:10
S49	21	second near2 conductive near3 layer same electrical near3 resistivity same less	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:11
S50	7	middle near2 conductive near3 layer near3 (thicker)	US-PGPUB; USPAT	OR	OFF	2018/09/06 10:34
S51	22	(middle mid center centre) near2 conductive near3 (layer section part) near3 (thicker wider fatter)	US-PGPUB; USPAT	OR	OFF	2018/09/06 13:56
S52	35,893	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2018/09/06 13:56
S53	0	S51 and S52	US-PGPUB; USPAT	OR	OFF	2018/09/06 13:56
S55	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:29

S56	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:29
S57	1	"6504202".pn.	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:29
S58	1	"20160103549".pn.	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:32
S59	0	first same third same conduct\$3 same layer same titanium	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:34
S60	5,389	first same third same conduct\$3 same layer same titanium	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:34
S61	35,893	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:35
S62	4,524	first same third same conduct\$3 same layer same titanium and aluminum	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:35
S63	3,038	first same third same conduct\$3 same layer same titanium same aluminum	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:35
S64	122	S61 and S63	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:36
S65	1,108	first near2 conduct\$3 same second near2 conduct\$3 same third near2 conduct\$3 same layer same Titanium same Aluminum	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:42
S66	28	S61 and S65	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:43
S67	1,153	aluminum near2 layer same (between sorrounded) near3 Titanium	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:50
S68	641	aluminum near2 layer same (between sorrounded) near3 Titanium near2 layer	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:50
S69	66	S61 and S68	US-PGPUB; USPAT	OR	OFF	2018/09/07 09:51
S70	183	towfiq near elahi	US-PGPUB; USPAT	OR	OFF	2018/09/07 10:31

S71	2	"20140320769"	US-PGPUB; USPAT	OR	OFF	2018/09/07 10:36
S72	1	"20170076502"	US-PGPUB; USPAT	OR	OFF	2018/09/07 12:39
S73	1	"20180095581"	US-PGPUB; USPAT	OR	OFF	2018/09/10 09:54
S74	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/27 15:40
S75	204	towfiq near2 elahi	US-PGPUB; USPAT	OR	OFF	2019/02/27 15:47
S76	5	("20100060602" "20110102370" "20120118614" "20120212449" "20120312677").PN. OR ("9323370").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/02/27 16:04
S77	75	"20060097991"	US-PGPUB; USPAT; USOCR	OR	OFF	2019/02/27 16:06
S78	1	"15660827" and (thickness near3 second near2 connection part\$1)	US-PGPUB; USPAT	OR	OFF	2019/02/28 08:51
S79	0	"15660827" and (thickness near3 second near2 connection near2 part\$1)	US-PGPUB; USPAT	OR	OFF	2019/02/28 08:52
S80	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/28 14:48
S81	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2019/02/28 14:58
S82	2	"20140320769"	US-PGPUB; USPAT	OR	OFF	2019/02/28 15:21
S83	1	"15660827"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S84	14	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S85	0	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern same touch	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S86	0	insula\$3 near2 pattern near3 between near3 first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern and touch	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S87	15	insula\$3 near2 pattern near3 between same first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S88	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S89	2	"20160103549"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S90	1	"20160147335"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S91	2	"20170336907"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S92	2	"20140160066"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S93	0	((("AN") near3 ("Chiwook"))).INV.	USPAT	OR	OFF	2019/02/28 17:00
S94	12	((("KIM") near3 ("Doyeon"))).INV.	US-PGPUB	OR	OFF	2019/02/28 17:00
S95	10	((("PARK") near3 ("Sunghyun"))).INV.	USPAT	OR	OFF	2019/02/28 17:00
S96	22	((("LEE") near3 ("Jaehyun"))).INV.	USPAT	OR	OFF	2019/02/28 17:00
S97	0	((("CHO") near3 ("Sung-woong"))).INV.	USPAT	OR	OFF	2019/02/28 17:00
S98	0	((("CHO") near3 ("Sung-woong"))).INV.	USPAT	OR	OFF	2019/02/28 17:00
S99	4	insula\$3 near2 pattern near3 between same first near3 conduct\$3 near3 pattern near5 second near3 conduct\$3 near2 pattern and display	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S100	0	touch near3 (sens\$3 detect\$3) near3 on near3 display near3 (part section substrate)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S101	222	touch near3 (sens\$3 detect\$3) near3 display near3 (part section substrate) same insulat\$3	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S102	39,064	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S103	193	S101 and S102	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S104	1	"20160147335"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S105	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S106	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S107	2	"20160103549"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S108	0	(first second third) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third) near3 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S109	0	(first second third one) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third) near3 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S110	0	(first second third one) near3 conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third other another) near3 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S111	0	conductive near3 layer near3 resistivi near3 (less lower) near3 (first second third other another) near3 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S112	0	conductive near3 layer near3 resistivi near3 (less lower different) near3 (first second third other another) near3 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S113	1,162,602	(first second third other another) near3 layer conductive near3 layers near3 resistivi near3 (less lower different)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S114	39,064	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S115	17,063	S113 and S114	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S116	1,162,583	(first second third) near3 layer conductive near3 layers near3 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S117	17,063	S114 and S116	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S118	1,612,494	(first second third one) near3 layer conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same than near3 (first second third other another)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S119	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same than near3 (first second third other another)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S120	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) same (first second third other another)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S121	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different) and (first second third other another)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S122	0	(first second third one) near3 layer near3 conductive near3 layers near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S123	0	(first second third one) near3 layer near3 conduct\$3 near3 layers near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S124	0	(first second third one) near3 layer near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S125	0	(first second third one) near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi near3 (less lower different more)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S126	0	(first second third one) near3 conduct\$3 near3 layer\$1 near3 electrical near2 resistivi	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S127	0	conduct\$3 near3 layer\$1 near3 electrical near2 resistivi	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S128	214,000	second near2 conductive layer near3 electrical near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S129	0	second near2 conductive near3 layer near3 electrical near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S130	0	second near2 conductive near3 layer near3 resistivity near3 less near3 than	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S131	22	second near2 conductive near3 layer same electrical near3 resistivity same less	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S132	8	middle near2 conductive near3 layer near3 (thicker)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S133	23	(middle mid center centre) near2 conductive near3 (layer section part) near3 (thicker wider fatter)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S134	39,064	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S135	0	S133 and S134	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S136	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S137	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S138	1	"6504202".pn.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S139	1	"20160103549".pn.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S140	0	first same third same conduct\$3 same layer same titanium	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S141	5,648	first same third same conduct\$3 same layer same titanium	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S142	39,064	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S143	4,756	first same third same conduct\$3 same layer same titanium and aluminum	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S144	3,209	first same third same conduct\$3 same layer same titanium same aluminum	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S145	145	S142 and S144	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S146	1,129	first near2 conduct\$3 same second near2 conduct\$3 same third near2 conduct\$3 same layer same Titanium same Aluminum	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S147	33	S142 and S146	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S148	1,191	aluminum near2 layer same (between sorrounded) near3 Titanium	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S149	667	aluminum near2 layer same (between sorrounded) near3 Titanium near2 layer	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S150	73	S142 and S149	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S151	204	towfiq near elahi	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S152	2	"20140320769"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S153	1	"20170076502"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S154	1	"20180095581"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S155	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S156	204	towfiq near2 elahi	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00

S157	5	("20100060602" "20110102370" "20120118614" "20120212449" "20120312677").PN. OR ("9323370").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/02/28 17:00
S158	75	"20060097991"	US-PGPUB; USPAT; USOCR	OR	OFF	2019/02/28 17:00
S159	1	"15660827" and (thickness near3 second near2 connection part\$1)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S160	0	"15660827" and (thickness near3 second near2 connection near2 part\$1)	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S161	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S162	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S163	2	"20140320769"	US-PGPUB; USPAT	OR	OFF	2019/02/28 17:00
S164	0	second near3 conductive near3 pattern near4 thickness near4 (greater bigger (more adj than)) near3 thickness near3 second near3 connection near3 part	US-PGPUB; USPAT	OR	OFF	2019/05/09 11:00
S165	0	conductive near3 pattern near4 thickness near4 (greater bigger (more adj than)) near3 thickness near3 connection near3 part	US-PGPUB; USPAT	OR	OFF	2019/05/09 11:04
S166	263	second near3 conductive near3 pattern near4 thickness near4 (greater bigger (more adj than)) samr thickness near3 second near3 connection near3 part	US-PGPUB; USPAT	OR	OFF	2019/05/09 11:05
S167	1,006	second near3 conduct\$3 near3 pattern near4 (thickness width) near4 (greater bigger (more adj than)) samr (thickness width) near3 second near3 connect\$3 near3 (part section)	US-PGPUB; USPAT	OR	OFF	2019/05/09 11:10
S168	0	second near3 conduct\$3 near3 pattern near4 (thickness width) near4 (greater bigger (more adj than)) same (thickness width) near3 second near3 connect\$3 near3 (part section)	US-PGPUB; USPAT	OR	OFF	2019/05/09 11:10

S169	1	"16742230"	US-PGPUB; USPAT	OR	OFF	2020/07/29 10:30
S170	1	"10541279" .pn.	US-PGPUB; USPAT	OR	OFF	2020/07/29 10:31
S171	7	buffer near2 layer near2 directly near3 encapsulation near layer	US-PGPUB; USPAT	OR	OFF	2020/07/29 11:49
S172	3	buffer near2 directly near3 encapsulation near layer	US-PGPUB; USPAT	OR	OFF	2020/07/29 11:54
S173	5	buffer near2 directly near3 encapsulation	US-PGPUB; USPAT	OR	OFF	2020/07/29 11:54
S174	2	"20100182273"	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:13
S175	2	"20160041644"	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:14
S176	2	"20140320769"	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:15
S177	2	"20160103549"	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:20
S178	0	buffer same encaptulation same conductive near2 pattewrn	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:28
S179	0	buffer same encaptulation same conductive near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:28
S180	0	buffer same encaptulation same (conductive metal) near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:28
S181	0	buffer near2 layer and encaptulation near2 layer and (conductive metal) near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:29
S182	2	"20180166507"	US-PGPUB; USPAT	OR	OFF	2020/07/29 15:57
S183	11	("20090058250" "20100265206" "20140049522" "20150049263" "20150091849" "20150153881" "20150355771" "20160179264" "20170083140" "20170277296"	US-PGPUB; USPAT; USOCR	OR	OFF	2020/07/29 16:02

		"20170321087").PN. OR ("10720474").URPN.				
S184	286	buffer near2 layer near3 encapsulation near layer	US-PGPUB; USPAT	OR	OFF	2020/07/29 16:12
S185	49,085	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2020/07/29 16:13
S186	135	S184 and S185	US-PGPUB; USPAT	OR	OFF	2020/07/29 16:13
S187	3,004,158	S184 and S185 and conductive neae2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 16:13
S188	12	S184 and S185 and conductive near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 16:14
S189	35	("10268238" "20080277259" "20100182250" "20110285661" "20130002569" "20130147727" "20130278513" "20140028599" "20140078108" "20140078692" "20140217373" "20140217382" "20140217397" "20140232956" "20140256070" "20150193058" "20160093685" "20160306472" "20160315284" "7864503" "7920129" "8274488" "8358284" "8461760" "8698768" "8730191" "8946690" "9001079" "9035907" "9046952" "9128569" "9239654" "9335881" "9515131" "RE44866").PN. OR ("10707280").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/07/29 16:17
S190	0	buffer near2 layer and encaptulation near2 layer and (conductive metal touch sesnor detector) near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 17:19
S191	0	buffer near2 layer and encaptulation near2 layer and (conductive metal touch sensor or detector) near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/29 17:19
S192	0	buffer near2 layer and encaptulation near2 layer and (conductive metal touch sensor or detector)	US-PGPUB; USPAT	OR	OFF	2020/07/29 17:20
S193	2	insulation near2 layer near3 encapsulation near layer same conductive near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/30 09:22
S194	26	insulation near2 layer near3 encapsulation near layer and conductive near2 pattern	US-PGPUB; USPAT	OR	OFF	2020/07/30 09:24

S195	1	"16742230"	US-PGPUB; USPAT	OR	OFF	2020/07/30 11:35
S196	0	first conductive layer near3 buffer layer same second conductive layer same first conductive layer third conductive layer near3 second conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 15:40
S197	2	second conductive pattern near4 fourth conductive layer same insulating layer same fifth conductive layer same fourth conductive layer same sixth conductive layer same fifth conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 15:52
S198	3	second conductive layer same fifth conductive layer near3 aluminum	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 15:55
S199	9	thickness near3 second conductive layer near3 greater near4 thickness near3 first conductive layer near3 thickness near4 third conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 16:38
S200	1	(thickness or width) near3 fifth conductive layer near3 (greater or bigger or larger) near4 (thickness or width) near3 fifth conductive layer near3 (thickness or width) near3 sixth conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 16:43
S201	0	thicknessnear3 insulating layer near3 less near3 thickness near3 second conductive pattern	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:00
S202	1	thickness near3 insulating layer near3 less near3 thickness near3 second conductive pattern	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:00
S203	6	thickness near3 insulating layer near3 less near3 thickness near3 conductive pattern	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:01
S204	2	"20160103549"	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:07
S205	3	(thickness or width) near3 second conductive layer near3 (less or smaller) near3 (thickness or width) near3 fifth conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:20
S206	1	(thickness or width) near3 (difference or variation) near3 second conductive layer near3 first conductive layer near3 greater near3 (thickness or width) near3 (difference or variation) near3 third conductive layer near3 first conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:23

S207	1	(thickness or width) near3 (difference or variation) near3 fifth conductive layer near3 fourth conductive layer near3 greater near3 (thickness or width) near3 (difference or variation) near3 sixth conductive layer near3 fourth conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:25
S208	1	(thickness or width) near3 (difference or variation) near3 fifth conductive layer near3 fourth conductive layer near3 greater near3 (thickness or width) near3 (difference or variation) near3 second conductive layer near3 first conductive layer	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:26
S209	2	"20100110023"	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:34
S210	2	"20110193793"	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:34
S211	1	"20150085205"	US-PGPUB; USPAT	NEAR	OFF	2020/07/30 17:35
S212	2	"20160162060"	US-PGPUB; USPAT	OR	OFF	2020/07/30 17:39
S213	2	"20170336907"	US-PGPUB; USPAT	OR	OFF	2020/07/30 17:39
S214	1	"20200152710"	US-PGPUB; USPAT	OR	OFF	2021/04/14 09:34
S215	2	"20160313837"	US-PGPUB; USPAT	OR	OFF	2021/04/14 09:43
S216	2	"20140232956"	US-PGPUB; USPAT	OR	OFF	2021/04/14 09:44
S217	1	"6504202".pn.	US-PGPUB; USPAT	OR	OFF	2021/04/14 09:44
S218	1	"20210048921".pn.	US-PGPUB; USPAT	OR	OFF	2021/04/14 10:39
S219	362	insulating near2 layer near3 between near4 conductive near2 patterns	US-PGPUB; USPAT	OR	OFF	2021/04/14 10:42

S220	40,306	(H01L27/323 G06F3/0412 G06F3/044 G09G3/3225 H01L51/5256).cpc.	US-PGPUB; USPAT	OR	OFF	2021/04/14 10:42
S221	25	S219 and S220	US-PGPUB; USPAT	OR	OFF	2021/04/14 10:42
S222	193,753	345/\$.ccls.	US-PGPUB; USPAT	OR	OFF	2021/04/14 10:46
S223	11	S219 and S222	US-PGPUB; USPAT	OR	OFF	2021/04/14 10:46
S224	207	insulating near2 layer near3 between near2 conductive near2 patterns	US-PGPUB; USPAT	OR	OFF	2021/04/14 10:57
S225	4	insulating near2 layer near3 between near2 conductive near2 patterns with display near device	US-PGPUB; USPAT	OR	OFF	2021/04/14 10:57
S226	13	insulating near2 layer near3 between near2 conductive near2 (patterns layers) with display near device	US-PGPUB; USPAT	OR	OFF	2021/04/14 10:58

EAST Search History (Interference)

<This search history is empty>

4/14/2021 2:36:30 PM

C:\Users\telahi\Documents\EAST\Workspaces\16742230_Con_15660827.wsp

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (use as many sheets as necessary)	Attorney Docket Number	183539
	Application Number	16/742,230
	Filing Date	January 14, 2020
	Inventor(s)	Chiwook An, et al.
	Group Art Unit	2625
	Examiner Name	Towfiq Elhal

U.S. PATENT DOCUMENTS				
EXAMINER INITIALS	Cite No. ¹	DOCUMENT NUMBER Number - Kind Code ² (If Known)	PUBLICATION DATE OR ISSUE DATE MM-DD-YYYY	NAME OF PATENTEE
		8,325,312 B2	12-04-2012	Seo et al.
		8,629,842 B2	01-14-2014	Jang
		2010/0182273 A1	07-22-2010	Noguchi et al.
		2013/0285938 A1	10-31-2013	Kang et al.
		2015/0280154 A1	10-01-2015	Jang et al.
		2016/0043320 A1	02-11-2016	Kwon
		2016/0103549 A1	04-14-2016	Lee et al.

FOREIGN PATENT DOCUMENTS					
EXAMINER INITIALS	Cite No. ¹	Foreign Patent Document Country Code ³ - Number ⁴ - Kind Code ⁵ (If Known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T ⁶ (✓)
		CN 101398588 A	04-01-2009	Seo et al.	Corresponds to US 8,325,312 B2 as listed above.
		CN 105511665 A	04-20-2016	Lee et al.	Corresponds to US 2016/0103549 A1 as listed above.
		CN 101681221 A	03-24-2010	Noguchi et al.	Corresponds to US 2010/0182273 A1 as listed above.
		CN 101626017 A	01-13-2010	Jang	Corresponds to US 8,629,842 B2 as listed above.

EXAMINER SIGNATURE		DATE CONSIDERED	
EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. ³ Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English Language Translation is attached.			

RMS/srh

Sheet 1 of 2

C:\NRPortbl\FIRM\RMS\114375998_1.docx

<p align="center">INFORMATION DISCLOSURE</p> <p align="center">STATEMENT BY APPLICANT</p> <p align="center">(use as many sheets as necessary)</p>	Attorney Docket Number	183539
	Application Number	16/742,230
	Filing Date	January 14, 2020
	Inventor(s)	Chiwook An, et al.
	Group Art Unit	2625
	Examiner Name	Towfiq Elhal

OTHER DOCUMENTS		
EXAMINER INITIALS	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article, title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.

EXAMINER SIGNATURE		DATE CONSIDERED	
<p>EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹Applicant's unique citation designation number (optional). ²See Kinds Codes of USPTO Patent Documents at www.pto.gov or MPEP 901.4. ³Enter Office that issued the document, by the two-letter code (WIPO standard ST.3). ⁴For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶Applicant is to place a check mark here if English Language Translation is attached.</p>			

RMS/srh

Sheet 2 of 2

C:\NRPortb\FIRM\RMS\114375998_1.docx

[19] 中华人民共和国国家知识产权局



[12] 发明专利申请公布说明书

[21] 申请号 200810145864.7

[51] Int. Cl.

G02F 1/1362 (2006.01)

G02F 1/1339 (2006.01)

H01L 27/12 (2006.01)

H01L 21/84 (2006.01)

[43] 公开日 2009年4月1日

[11] 公开号 CN 101398588A

[22] 申请日 2008.8.7

[21] 申请号 200810145864.7

[30] 优先权

[32] 2007.9.28 [33] KR [31] 10-2007-0097932

[71] 申请人 乐金显示有限公司

地址 韩国首尔

[72] 发明人 徐贤真 李政训 权 当 赵恒燮
金湫洙

[74] 专利代理机构 北京律诚同业知识产权代理有限公司
代理人 徐金国

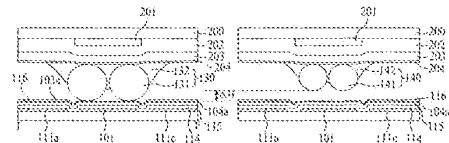
权利要求书 4 页 说明书 18 页 附图 6 页

[54] 发明名称

液晶显示器件及其制造方法

[57] 摘要

本发明公开了一种液晶显示(LCD)器件及其制造方法,其能够通过应用球状衬垫料维持盒间隙并防止预定外部压力所引起的挤压缺陷。液晶显示器件包括:相互面对的第一和第二基板,在第一和第二基板上以矩阵的形式限定有多个子像素;形成于第一基板上的多条栅线 and 多条数据线;形成于栅线和数据线的交叉点的多个薄膜晶体管;形成于第二基板上的黑矩阵层;形成于黑矩阵层上预定部分中的多个第一衬垫料和多个第二衬垫料,第一衬垫料包括具有第一直径的多个第一球和用于聚合第一球的第一固体,第二衬垫料包括具有比第一直径小0.2至0.6 μm 的第二直径的多个第二球和聚合第二球的第二固体;以及填充在第一和第二基板之间的液晶层。



1、一种液晶显示器件，包括：

相互面对的第一基板和第二基板，其中在第一基板和第二基板上以矩阵的形式限定有多个子像素，每个子像素包括像素区域和与像素区域相邻的非像素区域；

形成于所述第一基板上的各个非像素区域中的多条栅线和多条数据线，从而，所述栅线和所述数据线相互交叉以限定所述像素区域；

多个薄膜晶体管，其中每个形成于所述栅线中相关联的一条栅线和所述数据线中相关联的一条数据线之间的交叉点；

形成于所述第二基板上对应于所述非像素区域的部分中的黑矩阵层；

形成于所述第一和第二基板之间并且在所述黑矩阵层上预定部分中的多个第一衬垫料，所述第一衬垫料包括具有第一直径的多个第一球和用于聚合所述第一球的第一固体；

形成于所述第一和第二基板之间并且在所述黑矩阵层上的预定区域中的多个第二衬垫料，所述第二衬垫料包括具有比所述第一直径小 0.2 至 0.6 μm 的第二直径的多个第二球和聚合所述第二球的第二固体；以及

填充在所述第一基板和所述第二基板之间的液晶层。

2、根据权利要求 1 所述的液晶显示器件，其特征在于，所述第一球的所述第一直径为 2.0 至 5.0 μm 。

3、根据权利要求 1 所述的液晶显示器件，其特征在于，所述第一衬垫料在每个子像素上排列的比率为从 1/100 至 1/2，以及所述第二衬垫料在每个子像素上排列的比率为从 1/100 至 1/1。

4、根据权利要求 3 所述的液晶显示器件，其特征在于，所述第一衬垫料和第二衬垫料排列在所述第二基板上，从而所述第二衬垫料与所述第一衬垫料的比率为从 10 至 20。

5、根据权利要求 3 所述的液晶显示器件，其特征在于，所述第一衬垫料是通过喷墨第一衬垫料材料然后固化形成的，以及所述第二衬垫料是通过喷墨第二衬垫料材料然后固化形成的，

其中，所述第一衬垫料材料包括液态热固性粘结剂、溶剂和第一球，如果

液态热固性粘结剂和溶剂的总重量为 100wt%，

液态热固性粘结剂的重量为 1 wt%至 20 wt%并且溶剂的重量为 80wt%至 99wt%；并且

所述第一球的重量为相对于所述热固性粘结剂和所述溶剂的总重量的 0.1 至 3 wt%；以及

所述第二衬垫料材料包括液态热固性粘结剂、溶剂和第二球，如果液态热固性粘结剂和溶剂的总重量为 100wt%，

液态热固性粘结剂的重量为 1 wt%至 20 wt%并且溶剂的重量为 80wt%至 99wt%；并且

所述第二球的重量为相对于所述热固性粘结剂和所述溶剂的总重量的 0.1 至 3 wt%。

6、根据权利要求 5 所述的液晶显示器件，其特征在于，在所述第一衬垫料中的所述液态热固性粘结剂的含量(wt%)高于包含在所述第二衬垫料中的所述液态热固性粘结剂的含量。

7、根据权利要求 1 所述的液晶显示器件，其特征在于，所述第一和第二固体包括有机丙烯酸、聚氨酯以及环氧化合物中至少之一。

8、根据权利要求 1 所述的液晶显示器件，其特征在于，所述第一和第二固体包括有机硅化合物。

9、根据权利要求 1 所述的液晶显示器件，其特征在于，进一步包括形成于包括所述黑矩阵层的所述第二基板上的滤色片层。

10、根据权利要求 9 所述的液晶显示器件，其特征在于，进一步包括形成于包括所述黑矩阵层和所述滤色片层的所述第二基板的整个表面上方的涂覆层。

11、根据权利要求 9 所述的液晶显示器件，其特征在于，进一步包括形成于包括所述黑矩阵层和所述滤色片层的所述第二基板的整个表面上方的公共电极。

12、根据权利要求 10 或 11 所述的液晶显示器件，其特征在于，进一步包括形成于包括所述栅线和所述数据线的所述第一基板上的第一定向膜，以及形成于排列在所述第二基板上的所述涂覆层或所述公共电极上的第二定向膜。

13、一种用于制造液晶显示器件的方法，包括：

制备第一基板和第二基板，其中在第一基板和第二基板上以矩阵形式限定有多个子像素，每个子像素包括像素区域和与所述像素区域相邻的非像素区域；

在所述第一基板上的各个非像素区域中形成多条栅线和多条数据线，从而，所述栅线和所述数据线相互交叉以限定像素区域；

形成多个薄膜晶体管，所述薄膜晶体管形成在所述栅线中相关联的一条栅线和所述数据线中相关联的一条数据线之间的每个交叉点；

在所述第二基板上对应所述非像素区域的部分中形成黑矩阵层；

在所述第一和第二基板之间所述黑矩阵层上的预定区域中喷墨第一衬垫料材料以形成多个第一衬垫料，其中所述第一衬垫料材料包括具有第一直径的多个第一球、液态热固性粘结剂以及溶剂；

在所述第一和第二基板之间所述黑矩阵层上的预定区域中喷墨第二衬垫料材料以形成多个第二衬垫料，其中所述第二衬垫料材料包括具有比第一直径小0.2至0.6 μm 的第二直径的多个第二球、液态热固性粘结剂以及溶剂；以及

在所述第一基板和所述第二基板之间形成液晶层，并粘接所述第一基板和所述第二基板。

14、根据权利要求13所述的方法，其特征在于，形成所述第一和第二衬垫料的步骤是通过应用相互平行排列的含有第一球的喷头和含有第二球的喷头同时喷墨所述第一和第二衬垫料材料实施的。

15、根据权利要求13所述的方法，其特征在于，所述第一球的所述第一直径为2.0至5.0 μm 。

16、根据权利要求13所述的方法，其特征在于，

如果包含在第一衬垫料材料中的液态热固性粘结剂和溶剂的总重量为100wt%，在第一衬垫料材料中：

液态热固性粘结剂的重量为1 wt%至20 wt%并且溶剂的重量为80wt%至99wt%；并且

所述第一球的重量为相对于所述热固性粘结剂和所述溶剂的总重量的0.1至3 wt%；以及

如果包含在所述第二衬垫料材料中的液态热固性粘结剂和溶剂的总重量为100wt%，在第二衬垫料材料中：

液态热固性粘结剂的重量为1 wt%至20 wt%并且溶剂的重量为

80wt%至 99wt%；并且

所述第二球的重量为相对于所述热固性粘结剂和所述溶剂的总重量的 0.1 至 3 wt%。

17、根据权利要求 16 所述的方法，其特征在于，在所述第一衬垫料中的所述液态热固性粘结剂的含量(wt%)高于包含在所述第二衬垫料中的所述液态热固性粘结剂的含量。

18、根据权利要求 16 所述的方法，其特征在于，所述第一衬垫料的所述第一固体和所述第二衬垫料的所述第二固体是通过加热工艺固化所述液态热固性粘结剂并且蒸发所述溶剂形成的。

19、根据权利要求 18 所述的方法，其特征在于，加热工艺是在 80 至 300 °C 执行的。

20、根据权利要求 13 所述的方法，其特征在于，所述第一和第二衬垫料排列在所述第二基板上，从而所述第二衬垫料和第一衬垫料的比例为从 10 至 20。

液晶显示器件及其制造方法

本申请要求享有 2007 年 9 月 28 日提出的申请号为 No.P07-0097932 的韩国专利申请的优先权，在此结合其全部内容作为参考。

技术领域

本发明涉及一种液晶显示（LCD）器件，更具体地说，本发明涉及一种能够通过应用球状衬垫料维持盒间隙并防止由于施加预定外部压力所引起的挤压缺陷（press defect）的液晶显示（LCD）器件及其制造方法。

背景技术

在下文中，将参照附图说明传统的液晶显示器件。

图 1 为说明传统液晶显示器件的截面图。

如图 1 所示，传统 LCD 器件包括相互面对的第一基板 10 和第二基板 20，排列在第一基板 10 上从而它们相互交叉以限定像素区域的栅线 11 和数据线（未示出），形成于每个像素区域中的像素电极，以及密封于第一基板 10 和第二基板 20 之间的液晶层（未示出）。

此处，栅绝缘膜 14 设置于包括栅线 11 的第一基板 10 的整个表面上；数据线（未示出）设置在栅绝缘膜 14 上，从而数据线与栅线 11 交叉；钝化膜 15 设置在由包括数据线的栅绝缘膜 14 提供的部分；以及像素电极（未示出）设置于由钝化膜 15 提供与像素区域相对应的部分中。

黑矩阵 21 设置于第二基板 20 上与栅线、数据线以及薄膜晶体管相应的部分上；滤色片层 22 设置于包括黑矩阵层 21 的第二基板 20 上；以及，涂覆层 23 设置在黑矩阵层 21 和滤色片层 22 的整个表面上。

第一定向膜 16 设置在第一基板 10 上包括上述结构的钝化膜 15 上方；并第二定向膜 24 设置在第二基板 20 上涂覆层 23 上方。

综上所述，将第一柱状衬垫料 30 和第二柱状衬垫料 40 设置在栅线 11 上的不同预定部分中，其中，第一柱状衬垫料 30 具有对应于第一基板 10 和第二基板 20 之间的间隙的第一高度；并且，第二柱状衬垫料 40 具有比第一高度小 ΔH 的第二高度。

第一柱状衬垫料30的功能是维持第一基板10和第二基板20之间的盒间隙；而第二柱状衬垫料40与第一柱状衬垫料30共同抵抗施加的预定外部压力，从而防止由压力集中于任何一个衬垫料所引起的变形。

上述的传统液晶显示器件具有以下缺点：

首先，当应用柱状衬垫料时，它们具有与相对的基板相接触的很大的面积。由于这个原因，当通过接触操作施加摩擦力时，柱状衬垫料在被推向一个方向后需要很长时间才能恢复到原来的状态。在恢复到原来状态以前，产生显示缺陷。

第二，当应用球状衬垫料替代柱状衬垫料从而解决诸如触摸缺陷的缺点时，由于球状衬垫料的活动性而趋于滚入像素区域，从而引起了其他缺陷，例如显示缺陷。

发明内容

因此，本发明涉及一种液晶显示（LCD）器件及其制造方法，其基本上消除由于现有技术的局限性和缺陷引起的一个或多个问题。

本发明的一个目的在于提供一种液晶显示（LCD）器件及其制造方法，其能够通过应用球状衬垫料维持盒间隙（cell gap）并防止由于施加预定外部压力所引起的挤压缺陷。

本发明其他优点、目的和特征一部分将在以下描述中加以阐述，并且一部分对于本领域的普通技术人员在研究下文时变得显而易见或通过实施本发明而了解。本发明的目的及其他优点由在书面的说明书、权利要求书以及附图中具体指明的结构实现和获得。

为了获得这些目的和其它的优点并根据本发明的目的，如在此具体和广泛描述的，一种液晶显示器件包括：一种液晶显示器件，包括：相互面对的第一基板和第二基板，其中在第一基板和第二基板上以矩阵的形式限定有多个子像素，每个子像素包括像素区域和与像素区域相邻的非像素区域；形成于所述第一基板上的各个非像素区域中的多条栅线和多条数据线，从而，所述栅线和所述数据线相互交叉以限定所述像素区域；多个薄膜晶体管，其中每个形成于所述栅线中相关联的一条栅线和所述数据线中相关联的一条数据线之间的交叉点；形成于所述第二基板上的对应于所述非像素区域中的部分中的黑矩阵层；形成于所述第一和第二基板之间在所述黑矩阵层上预定部分中的多个第一衬垫

料, 所述第一衬垫料包括具有第一直径的多个第一球和用于聚合所述第一球的第一固体; 形成于所述第一和第二基板之间在所述黑矩阵层上的预定区域中的多个第二衬垫料, 所述第二衬垫料包括具有比所述第一直径小 0.2 至 0.6 μm 的第二直径的多个第二球和聚合所述第二球的第二固体; 以及填充在所述第一基板和所述第二基板之间的液晶层。

一种用于制造液晶显示器件的方法, 包括: 制备第一基板和第二基板, 其中在第一基板和第二基板上以矩阵形式限定有多个子像素, 每个子像素包括像素区域和与所述像素区域相邻的非像素区域; 在所述第一基板上的各个非像素区域中形成多条栅线 and 多条数据线, 从而, 所述栅线和所述数据线相互交叉以限定像素区域; 形成多个薄膜晶体管, 所述薄膜晶体管形成在所述栅线中相关联的一条栅线和所述数据线中相关联的一条数据线之间的每个交叉点; 在所述第二基板上对应所述非像素区域的部分中形成黑矩阵层; 在所述第一和第二基板之间所述黑矩阵层上的预定区域中喷墨第一衬垫料材料以形成多个第一衬垫料, 其中所述第一衬垫料材料包括具有第一直径的多个第一球、液态热固性粘结剂以及溶剂; 在所述第一和第二基板之间所述黑矩阵层上的预定区域中喷墨第二衬垫料材料以形成多个第二衬垫料, 其中所述第二衬垫料材料包括具有比第一直径小 0.2 至 0.6 μm 的第二直径的多个第二球、液态热固性粘结剂以及溶剂; 以及在所述第一基板和所述第二基板之间形成液晶层, 并粘接所述第一基板和所述第二基板。

应该理解, 本发明上面的概括性描述和下面的详细说明都是示例性和解释性的, 其目的在于对本发明的权利要求作进一步解释。

附图说明

本申请所包含的附图用于进一步理解本发明, 其与说明书相结合并构成本申请的一部分, 所示的本发明的实施方式与说明书一起解释本发明的原理。在图中:

图 1 所示为说明传统液晶显示器的截面图;

图 2 所示为说明根据本发明液晶显示器的平面图;

图 3 所示为说明沿图 2 中 I-I' 线提取的包括第一和第二衬垫料的液晶显示器的截面图;

图 4 所示为沿图 2 的 II-II', III-III' 以及 IV-IV' 线提取的截面图;

图 5 所示为说明用于形成根据本发明的液晶显示器的第二基板的方法的流程图;

图 6 所示为 LCD 器件的触摸缺陷、重力缺陷和液晶余量之间的关系,其中在 LCD 器件中应用了具有相同尺寸的球的衬垫料;以及

图 7 示出了 LCD 器件的触摸缺陷、重力缺陷和液晶余量之间的关系,其中 LCD 器件应用了具有不同尺寸的球的衬垫料。

具体实施方式

现在详细参照附图所示的示例,说明本发明的 LCD 器件及其制造方法的优选实施方式。尽可能的,相同的附图标记在所有的图中指代相同或相似的部分。

下文中,将参照附图说明根据本发明的 LCD 器件及其制造方法。

图 2 为说明根据本发明液晶显示器的平面图。图 3 为说明沿图 2 中 I-I' 线提取的包括第一和第二衬垫料的液晶显示器的截面图。图 4 为沿图 2 的 II-II', III-III' 以及 IV-IV' 线提取的截面图。

如图 2 至 4 所示,根据本发明的液晶显示器件包括:相互面对的第一基板 100 和第二基板 200;排列在第一基板 100 上的多条栅线 101 和多条数据线 102,这样栅线 101 和数据线 102 相互交叉以限定像素区域;位于相关联的栅线和数据线的每个交叉点的薄膜晶体管(TFT),以及交替排列在各个像素区域中的像素电极 103 和公共电极 104;以及密封在第一基板 100 和第二基板 200 之间的液晶层(未示出)。

下面将参照图 2 和图 3 详细描述第二基板 200 的结构。

第二基板 200 包括:黑矩阵层 201,用于阻挡光入射到像素区域以外的其他区域,例如,与栅线、数据线以及薄膜晶体管相对应的部分;R, G 以及 B 滤色片层 202,用于再现对应像素区域中的颜色;以及排列在黑矩阵层 201 和滤色片层 202 的整个表面上的涂覆层 203。

第二基板 200 进一步包括排列在保护膜 203 上的第二定向膜 204,以及排列在由第二定向膜 204 上由黑矩阵层 201 提供的不同区域中的第一衬垫料 130 和第二衬垫料 140。

如图 3 中所示,第一衬垫料 130 包括:直径对应第一基板 100 和第二基板 200 之间的间隙的多个第一球 131;以及第一固体 132,用于使第一球 131 以集合的形式粘附在第二定向膜 204 的表面上。

另外，第二衬垫料 140 包括：直径小于构成第一衬垫料 130 的第一球 131 的直径的多个第二球 141；以及第二固体 142，用于使第二球 141 以集合的形式粘附在第二定向膜 204 的表面上。

在这种情况下，第一衬垫料 130 和第二衬垫料 140 包括尺寸相互不同但由相同材料形成的第一球 131 和第二球 141。即是，第一衬垫料 130 和第二衬垫料 140 的材料各包括：具有预定尺寸的多个球；液相热固性粘结剂，其在固化为固体之前为液态；以及溶剂。为了改变包含于第一衬垫料 130 和第二衬垫料 140 的球的数量以及为了改变第一衬垫料 130 和第二衬垫料 140 的粘着水平 (adherence level)，可增加或减少热固性液态粘结剂的数量。

另外，第一衬垫料 130 和第二衬垫料 140 排列在第二基板 200 上的结构中的黑矩阵层 201 上，而在同时，第一球 130 和第二球 140 与设置在第一基板 100 上的结构中的栅线 101、公共线 111 和与这些线排列在相同层中的其它线相对。

由“ ΔH ”表示的第一衬垫料 130 和第二衬垫料 140 之间的高度差为大约 0.1 至 1 μm 。在这种情况下，第一衬垫料 130 的高度为大约 2.0 至 5.0 μm ，第二衬垫料 140 的高度比第一衬垫料 130 的高度小 ΔH ，而第一衬垫料 130 和第二衬垫料 140 的高度分别是由第一球和第二球组成的第一衬垫料和第二衬垫料所决定的。

优选情况下，考虑到在触摸缺陷和重力缺陷两方面的有效改进，第一衬垫料 130 和第二衬垫料 140 之间的高度差 ΔH 为 0.2 至 0.6 μm 。从下面将要说明的示出试验结果的曲线图中可以看出，当 ΔH 为大约 0.2 to 0.6 μm 时，可以获得更宽的液晶余量范围。

此外，第一衬垫料 130 的功能为维持第一基板 100 和第二基板 200 之间的盒间隙，而第二衬垫料 140 与第一衬垫料 130 一起抵抗施加到第一基板 100 和第二基板 200 的表面的预定的外部压力，从而防止任何一个衬垫料形状的变化。为了实现这些功能，第二衬垫料 140 的排布率 (arrangement ratio) 设计为大于第一衬垫料 130 的排布率。例如，每 20 个子像素中排列的第一衬垫料 130 的数量为 3.4，以及，每 20 个子像素中排列的第二衬垫料 140 的数量为 13.3。将相邻第二衬垫料 140 之间的间隙设置为小于相邻第一衬垫料 130 之间的间隙。在一些情况下，可以增加或减少第一衬垫料 130 和第二衬垫料 140 的排布率。衬垫料的排布率确定为在大约每 100 个子像素中具有 1 至 100 个衬垫料的范围内。与此同时，优选情况下，第一衬垫料 130 和第二衬垫料 140 设置在第二基板 200

上,从而,第二衬垫料 140 与第一衬垫料 130 的比值为从 10 至 20。

第一衬垫料 130 包括多个第一球 130,并且第二衬垫料 140 包括多个第二球 141。在形成第一衬垫料 130 和第二衬垫料 140 的喷墨工艺中,各个球并非在对应区域中分别喷射,而是在其中喷射各个包含多个球的滴(drop)。因此,由于在喷射以前,液体衬垫料材料展示出铺展性能并随后得到固化,第一衬垫料 130 和第二衬垫料 140 具有类椭圆形的水平截面。因此,分别包含第一球 131 和第二球 141 的第一衬垫料 130 和第二衬垫料 140 的水平截面并不局限为圆形。

这里,第一衬垫料 130 和第二衬垫料 140 是根据喷墨方法形成的,其通过从分离的喷头(head)向第二定向膜 204 的预定位置喷射衬垫料材料实现的。当每次喷射时,多个球 131 或 141 从每个喷头喷射入预定区域,并随后还在其中聚集。每个喷头中包含的衬垫料材料包括:液态热固性粘结剂(即液态的固体 132 或 142)、溶剂和多个球 131 和 141,其中,液态热固性粘结剂和溶剂的总重要为 100wt%,液态热固性粘结剂的重量为 1 wt% 至 20 wt%、溶剂的重量为 80wt%至 99wt%。并且,球的重量为相对于热固性粘结剂和溶剂的总重量的 0.1 至 3 wt%。

作为第一个示例性实施例,假设液态热固性粘接剂和溶剂的总重量为 100wt%,液态热固性粘接剂为 1wt%,溶剂为 99wt%,以及球为 0.1wt%。作为第二个示例性实施例,假设液态热固性粘接剂和溶剂的总重量为 100wt%,液态热固性粘接剂为 80wt%,溶剂为 20wt%,以及球为 3wt%。作为第三个示例性实施例,假设液态热固性粘接剂和溶剂的总重量为 100wt%,液态热固性粘接剂为 10wt%,溶剂为 90wt%,以及球为 2wt%。

在喷墨工艺中,这种包括多个球的衬垫料材料喷射入对应区域并随后在大约 80 至 300°C 固化。从而,液态热固性粘结剂固化并随后以包括多个第一球 131 和第二球 141 的聚合形式凝固,同时,溶剂蒸发。

在固化之前,固体 132 和 142 为液态形式的热固性粘结剂。例如,固体包括有机丙烯酸、聚氨酯(urethane)以及环氧化合物、或有机硅化合物(silicone compound)中至少之一。丙烯酸化化合物的特定的例子可包括甲基丙烯酸乙酯、甲基丙烯酸正丁酯、甲基丙烯酸异丁酯、甲基丙烯酸二环戊酯、丙烯酸苯甲酯、甲基丙烯酸缩水甘油酯、甲基丙烯酸 2-羟乙酯、甲基丙烯酸、甲基丙烯酸异冰片酯、苯乙烯单体以及它们的聚合物。总之,可单独应用丙烯酸化合物或其结

合。

可用做衬垫料材料的溶剂的沸点必须为 60 至 300°C。例如, 可将乙二醇醚用作该溶剂。可应用的乙二醇醚的例子包括丙二醇甲醚(PGME)、二丙二醇甲醚(DGME)、三丙二醇甲醚(TGME)、丙二醇甲醚乙酸酯(PGMEA)、二丙二醇甲醚乙酸酯(DGMEA)、丙二醇正丙醚(PGPE)、二丙二醇正丙醚(DGPE)、丙二醇正丁醚(PGBE)、二丙二醇正丁醚(DGBE)、三丙二醇正丁醚(TGBE)、丙二醇苯醚(PGPE)、丙二醇二乙酸酯(PGD)、二丙二醇二甲醚(DGDE)、二乙二醇乙醚(DGEE)、二乙二醇甲醚(DGME)、二乙二醇正丁醚(DGBE)、二乙二醇己醚(DGHE)、二乙二醇正丁醚乙酸酯(DGBEA)、乙二醇丙醚(EGPE)、乙二醇正丁醚(EGBE)、乙二醇己醚(EGHE)、乙二醇正丁醚乙酸酯(EGBEA)、三乙二醇甲醚(TGME)、三乙二醇乙醚(TGEE)、三乙二醇正丁醚(TGBE)、乙二醇苯醚(EGPE)以及乙二醇正丁醚混合物(EGBEM)。

优选情况下, 在室温下, 例如, 18~25°C 下, 溶剂的表面张力为 20 至 80 达因/厘米 (dynes/cm), 粘度为 1 至 30cP 并且密度为 0.8 至 1.2 g/cc。基于这些性质, 在大约 80 至 300°C 的固化过程中, 溶剂蒸发并被去除。

另外, 第一球 131 和第二球 141 是由诸如二乙烯基苯的有机化合物制成的。在各个喷头中第一球 131 和第二球 141 与固体 132 和 142 和溶液能够区分开, 从而形成第一衬垫料 130 和第二衬垫料 140, 在其中, 球表现为白色粉末的形式, 而固体 132 和 142 以及溶剂是液态的。如果需要, 第一球 131 以及第二球 141 在与其他衬垫料材料混合以前经过表面处理, 从而可以将它们与其他液体组分区分开。

如上所述, 第一衬垫料 130 和第二衬垫料 140 可形成于第二定向膜 204 上。作为另一种选择, 相反的, 在第一衬垫料 130 和第二衬垫料 140 形成于涂覆层 203 或公共电极上之后, 第二定向膜 204 可形成于包括第一衬垫料 130 和第二衬垫料 140 的涂覆层 203 或公共电极上。

第一衬垫料 130 和第二衬垫料 140 具有在黑矩阵层 201 的宽度范围内的二维类椭圆形状。即是, 越靠近衬垫料的中心, 相应的球 131 或 141 的数量增加, 以及, 另一方面, 越靠近衬垫料的边缘, 相应的球 131 或 141 的数量减少。第一固体 132 和第二固体 142 防止喷射在要形成第一衬垫料 130 和第二衬垫料 140 形成的部分中的第一球 131 和第二球 141 不是聚集而是扩散。从而, 第一固体

132 和第二固体 142 起到将第一球 131 和第二球 141 固定在第二定向膜 204 或涂覆层 203 上的作用。第一衬垫料 130 和第二衬垫料 140 为类椭圆形，其原因在于它们喷射为液态并因此部分地扩散。

这里，第一衬垫料 130 的功能为保持第一基板 100 和第二基板 200 之间的盒间隙。因为第二衬垫料 140 比第一衬垫料 130 短，所以只有在提供预定外部压力时，第二衬垫料 140 与第一基板 100 上提供的结构的最外顶表面（例如，第一定向膜 116）接触。因此，第二衬垫料 140 与第一衬垫料 130 一起抵抗外部压力，从而，防止由于压力仅集中在第一衬垫料 130 上引起的塑性变形（plastic deformation）。因此，可以避免由于塑性变形导致的挤压缺陷。

第一衬垫料 130 包括具有球形的球 131，并且具有与第一基板 100 上提供的结构的最外上表面相接触的点状（dot-like）的窄接触区域。由于这些原因，当发生第一基板 100 或第二基板 200 被向一个方向推的触摸操作时，能够减小衬垫料和相对基板之间的摩擦力。这就使得该基板很容易地还原到其最初状态并从而防止触摸缺陷。

其间，如图 2 至 4 中所示，滤色片层 202 可与黑矩阵层 201 一起排列在像素区域中。在一些情况下，滤色片层 202 可选择性地只排列在像素区域中，或者在由黑矩阵层 201 提供的部分中与黑矩阵层 201 部分地重叠或完全地重叠。

在下文中，将参照图 2 至图 4 说明地第一基板 100 上提供的结构。

多条栅线 101 和多条数据线 102 排列在面对第二基板 200 的第一基板 100 上，这样，栅线 101 和数据线 102 相互交叉，以限定像素区域。另外，公共线 111 排列在第一基板 100 上，从而，公共线与栅线 101 平行地延伸。

另外，薄膜晶体管位于关联的数据线和栅线的每个交叉点上。每个薄膜晶体管包括：从相关联的栅线 101 突出的栅极 101a；形成于包括栅极 101a、栅线 101 和公共线 111 的第一基板 100 的整个表面上的栅绝缘膜 114；排列在栅极 101a 两侧的“U”型的源极 102a 和漏极 102b，从而漏极 102b 部分位于“U”型源极 102a 中；以及排列在包括源极 102a 和漏极 102b 下的部分以及源极 102a 和漏极 102b 之间的沟道部分的区域中的半导体层 105（105a，105b）。半导体层 105 包括非晶硅层 105a 和排列在其上的掺杂半导体层（n+层）105b。掺杂半导体层 105b 是通过去除在源极 102a 和漏极 102b 之间的沟道部分形成的。源极 102a 的形状不局限于“U”型并且可以为“-”或“L”型。

栅线 102 具有在每个子像素中的中心弯曲部分。从而数据线形成 Z 字形线。公共线 111 与在每个像素的存储电极 111a 一体地形成，而且存储电极 111a 与第一公共电极连接电极 111b 相连接，该公共电极连接电极 111b 比邻数据线 102 的两侧并且与数据线 102 平行地突出。如上所述，数据线 102 与栅线 101 交叉，并在每个像素具有弯曲部分。本发明的优选实施方式不局限于这些，并且数据线可与栅线垂直交叉，或可以相对栅线以预定角度倾斜。在附图中，在每个像素为数据线 102 设置弯曲部分的原因是由于公共电极 104 和像素电极 103 与数据线平行地延伸，并从而基于弯曲部分形成垂直对称的电场，这使得液晶以不同方向排列，并从而改善视角。

公共电极 104 和像素电极 103 在每个像素区域的同一层组成透明电极并具有交替排列的部分。公共电极 104 与排列在其下的第一公共电极连接电极 111b 部分地重叠。与栅线 101 平行延伸的第二公共电极连接电极 111c 包括作为电接触的第二接触部分 117b，第二接触部分 117b 贯穿夹在第一基板 100 和第二公共电极连接电极 111c 之间的钝化膜 115 和栅绝缘膜 114。

另外，像素电极 103 从与第一存储电极 111a 相重叠的第二存储电极 103a 处分支，并具有作为电接触的第一接触部分 117a，该第一接触部分 117a 贯穿夹在像素电极 103 和漏极 102b 之间的钝化膜 115。

在下文中，将详细说明一种制造包括薄膜晶体管、公共电极、以及像素电极的第一基板 100 的结构的方法。

将诸如 Mo、Al 或 Cr 的金属沉积于第一基板 100 上，并随后通过光刻工艺对其构图，以同时形成多条栅线 101、栅极 101a、与栅线 101 平行延伸的公共线 111、与公共线 111 一体形成的第一存储电极 111a、以及从第一存储电极 111a 分支出的并突出至像素区域的第一公共电极连接电极 111b 和第二公共电极连接电极 111c。同时，栅极 101a 形成于由像素区域提供的预定位置中，从而它们从栅线 201 突出，并且第一存储电极 111a、第一公共电极连接电极 111b 和第二公共电极连接电极 111c 形成于相邻的像素区域之间的边界中。

随后，在提供有栅线 101、公共线 111、栅极 101a、第一存储电极 111a、以及第一和第二公共电极连接电极 111b 和 111c 的第一基板 100 上方沉积无机材料以形成栅绝缘膜 114。

随后，非晶硅层 105a 和掺杂半导体层 105b 相继沉积在栅绝缘膜 114 上方。

在所得到的结构上沉积诸如 Mo, Al 或 Cr 的金属, 并向其涂覆光敏膜。例如, 光敏膜可为负性光敏膜。

形成有在数据线、源极和漏极的部分定义为透光部分, 半导体层的沟道部分定义半透光部分, 并且在剩余的部分定义为遮光部分。这样, 对应遮光部分的掩模(未示出)位于光敏膜上。

随后, 光敏膜通过掩模被曝光并随后进行显影, 以形成第一光敏膜图案, 从而由透光部分提供的部分保持其全部厚度(保留未蚀刻), 由半透光部分提供的部分被去除到预定厚度, 而由遮光部分提供的部分去除其全部厚度(完全去除)。应用第一光敏膜图案(未示出)根据光刻工艺构图金属材料。第一光敏膜图案包括在每个像素区域具有弯曲部分并且与栅线 101 交叉的第一图案和在栅线 101 的交叉部分连接到第一图案并朝像素区域延伸的第二图案(包括形成源极和漏极的透光部分, 以及掩模的半透光部分)。在利用第一光敏膜图案构图金属之后, 形成了在每个像素具有弯曲部分的数据线 102a, 并且在由第二图案提供的部分中形成连接数据线 102 的虚拟图案(未示出)。

随后, 利用数据线 102 和虚拟图案作为掩模, 选择性去除掺杂半导体层 105b 和非晶硅层 105a。

随后, 对第一光敏膜图案进行灰化, 从而去除在第一光敏膜图案(未示出)中与掩模的半透光部分相对应并且具有相对较低厚度的光敏膜, 以形成第二光敏膜图案(未示出)。

随后, 利用第二光敏膜图案作为掩模, 选择性去除金属 102(位于与数据线 102 相同的层中)以及在虚拟图案中的暴露出的掺杂半导体层 105b 的部分, 以形成源极 102a 和漏极 102b, 并构图排列在其下的掺杂半导体层 105b。在这一工艺中, 去除了位于源极 102a 和漏极 102b 之间的掺杂半导体层 105b。这个去除的区域被定义为沟道部分。这时, 源极 102a 形成从数据线 102 向像素区域突出的“U”型。漏极 102b 以预定距离与源极 102a 分离开, 并部分地插入源极 102a 的“U”型中。

随后, 将钝化膜 115 沉积在提供有数据线 102、源极 102a 以及漏极 102b 的栅绝缘膜 114 上方。同时, 钝化膜 115 通常由诸如 SiN_x 的无机材料制成。为了增加液晶单元的孔径比, 可应用最近开发的诸如苯并环丁烯(BCB)、旋涂玻璃(spin on glass, SOG)或丙烯酸化合物的低介电有机材料。

随后，在漏极 102b 上的预定部分中选择性蚀刻钝化膜 115 以形成第一接触部分 117a，并选择性去除第二公共电极连接电极 111c 上的预定部分中提供的钝化膜 115 和绝缘膜 114，以形成第二接触部分 117b。

随后，在包括第一和第二接触部分 117a 和 117b 的钝化膜 115 上方沉积透明电极，并随后选择性去除，以形成多个公共电极 104、第三公共电极连接电极 104a 和多个像素电极 103，其中多个公共电极 104 在各个像素与第一公共电极连接电极 111b 部分地重叠并相互隔开，第三公共电极连接电极 104a 与排列在公共电极 104 上的第二公共电极连接电极 111c 相重叠，并将公共电极 104 连接到第二公共电极连接电极 111c，以及多个像素电极 103 与公共电极 104 彼此交替地排列。

随后，在包括像素电极 103 和公共电极 104 的钝化膜 115 的整个表面上方形形成第一定向膜 116。

图 5 为说明形成根据本发明的液晶显示器的第二基板的方法的流程图。

下面将参照图 3 和 5 详细描述形成根据本发明的液晶显示器的第二基板的方法。

首先，在第二基板 200 上除像素区域之外的区域形成黑矩阵层 201 (100S)。黑矩阵层 201 设计为阻挡光投射到与在除像素区域之外区域中提供的栅线、数据线和薄膜晶体管相应的部分中。

随后，在各个像素形成用于表现颜色的 R, G, B 滤色片层 202 (110S)。

随后，在黑矩阵层 201 和滤色片层 202 上方形成涂覆层 203 (120S)。

随后，在涂覆层 203 上形成第二定向膜 204。

随后，将预先确定的衬垫料材料从第一喷头（未示出）喷射到第二定向膜 204 上由黑矩阵层 201 提供的预定部分，并随后固化以形成第一衬垫料 130 (130S)。同时，在固化第一衬垫料 130 之前，将第一喷头填充衬垫料材料，衬垫料材料包括液态的热固性粘结剂、溶剂和多个具有第一直径的第一球 131，其中基于液态热固性粘结剂和溶剂的总重量，第一球 131 的量不多于 3 wt%。在固化第一衬垫料 130 的工艺中，溶剂蒸发并随后将其去除。

随后，将预先确定的衬垫料材料从第二喷头（未示出）喷射到第二定向膜 204 上由黑矩阵层 201 提供但是没有第一衬垫料 130 的预定部分中，并随后进行固化以形成第二衬垫料 140 (140S)。同时，在固化第二衬垫料 140 之前，将第二

喷头填满衬垫料材料，该衬垫料材料包括液态的热固性粘结剂、溶剂和多个具有第二直径的第二球 141，其中基于液态热固性粘结剂和溶剂的总重量，第二球 141 的量不多于 3 wt%。在固化第二衬垫料 140 的工艺中，将溶剂蒸发并随后将其去除。

分别包含于第一喷头和第二喷头中的第一球 131 和第二球 141 尺寸互相不同。通过将在固化第一固体前的状态中包含在第一喷头中的液态热固性粘结剂的含量设置为大于在固化第二固体前的状态中的包含在第二喷头中的液态热固性粘结剂的含量，具有较大直径的第一球的聚集力将大于第二球的聚集力，其中，在固化第一固体前的热固性粘结剂混合有第一球 131，由于其相对较大的直径其作为盒间隙。包含在各个喷头中的衬垫料材料包括 20wt%或更少的第一固体 132 的液态热固性粘结剂，和 20wt%或更少的第二固体 142 的液态热固性粘结剂。在限定的范围内，第一固体 132 的液态热固性粘结剂以更大的量与具有相对更大直径的第一球 131 混合。

用于维持盒间隙的第一衬垫料 130 的数量的范围在每 100 子像素排列 1 至 50 个。用于防止挤压缺陷的第二衬垫料 140 的数量范围在每 100 子像素排列 1 至 100 个。第二衬垫料 140 在外部压力施加到其上时起作用。通过增加第二衬垫料 140 的数量，第二衬垫料具有卓越的抗挤压性。因此，将第二衬垫料 140 的密度设计为高于第一衬垫料 130 的密度。

另外，在第二基板 200 的总区域中，分别包含在第一衬垫料 130 和第二衬垫料 140 中的第一球 131 和第二球 141 的形成密度为每平方毫米为 1 至几十个。

如图 3 中所示，第一衬垫料 130 包括：直径与第一基板 100 和第二基板 200 之间的间隙相当的多个第一球 131；以及第一固体 132，其使第一球 131 以集合的形式粘附在第二定向膜 204 的表面上。

另外，第二衬垫料 140 包括：多个直径小于构成第一衬垫料 130 的第一球 131 的直径的第二球 141；以及第二固体 142，其使第二球 141 以集合的形式粘附在第二定向膜 204 的表面上。

在这种情况下，第一衬垫料 130 和第二衬垫料 140 包括尺寸相互不同但由相同材料形成的第一球 131 和第二球 141。即是，第一衬垫料 130 和第二衬垫料 140 的材料各包括：具有预定尺寸的多个球；液态热固性粘结剂，其在固化为固体之前为液态；以及溶剂。为了改变包含于第一衬垫料 130 和第二衬垫料 140

中的球的数量以及其间的粘着水平 (adherence level)，可增加或减少液态热固性粘结剂的总量。

另外，在第二基板 200 上的结构中第一衬垫料 130 和第二衬垫料 140 排列的黑矩阵层 201 上，而同时在第一基板 100 上的结构中第一衬垫料 130 和第二衬垫料 140 排列在栅线 101，公共线 111 和与这些线排列在相同的层中的其他线上。

由“ ΔH ”表示的第一衬垫料 130 和第二衬垫料 140 之间高度差为大约 0.1 至 1 μm 。在这种情况下，第一衬垫料 130 的高度为大约 2.0 至 5.0 μm ，第二衬垫料 140 的高度比第一衬垫料 130 的高度小 ΔH ，而第一衬垫料 130 和第二衬垫料 140 的高度分别是由第一球和第二球组成的第一和第二衬垫料所决定的。

优选情况下，考虑到在触摸缺陷和重力缺陷两者的有效改进，第一衬垫料 130 和第二衬垫料 140 之间的高度差 ΔH 为 0.2 至 0.6 μm 。如下面将要说明的示出试验结果的曲线图中可以看出，当 ΔH 为大约 0.2 to 0.6 μm 时，能够获得更宽的液晶余量范围。

此外，第一衬垫料 130 的功能为维持第一基板 100 和第二基板 200 之间的盒间隙，而第二衬垫料 140 与第一衬垫料 130 一起抵抗施加到第一基板 100 和第二基板 200 的表面的预定外部压力，从而防止任何一个衬垫料形状的改变。为了实现这些功能，将第二衬垫料 140 的排布率设计为大于第一衬垫料 130 的排布率。例如，排列在每 20 个子像素中的第一衬垫料 130 的数量为 3.4，以及，排列在每 20 个子像素中的第二衬垫料 140 的数量为 13.3。将相邻第二衬垫料 140 之间的间隙设置为小于相邻第一衬垫料 130 之间的间隙。在一些情况下，可以增加或减少第一衬垫料 130 和第二衬垫料 140 的排布率。将衬垫料的排布率设置为在大约每 100 个子像素 1 至 100 个衬垫料的范围内。

第一衬垫料 130 和第二衬垫料 140 分别包括多个第一球 131 和多个第二球 141。在形成第一衬垫料 130 和第二衬垫料 140 的喷墨工艺中，各个球并非在对应区域中分别喷射，而是在其中喷射各个包含多个球的滴。因此，由于在喷射以前，液体衬垫料材料展示出铺展性能并随后得到固化，第一衬垫料 130 和第二衬垫料 140 具有类椭圆形的水平截面。因此，分别包含第一球 131 和第二球 141 的第一衬垫料 130 和第二衬垫料 140 的水平截面部分并不限于圆形。

这里，第一衬垫料 130 和第二衬垫料 140 是根据喷墨方法形成的，其通过

从分离的喷头向从第二定向膜 204 上的预定区域中喷射衬垫料材料而实现。当每次喷射，多个球 131 或 141 从每个喷头喷射入预定区域，并随后还在其中聚集。每个喷头中包含的衬垫料材料包括：1 wt% 至 20 wt% 的液态热固性粘结剂、即液态的固体 132 或 142、其余重量的溶剂（未示出）、以及相对于热固性粘结剂和溶剂的总重量的 0.1 至 3 wt% 的多个球 131 或 141。

在喷墨工艺中，这种包括多个球的衬垫料材料喷射入对应区域并随后在大约 80 至 300°C 固化。从而，液态热固性粘结剂经固化并随后以包括多个第一球 131 和第二球 141 的聚合形式凝固，同时，将溶剂蒸发。这时，分别应用喷头中所包含的第一球 131 和第二球 141 顺序形成第一衬垫料和第二衬垫料。作为另一种选择，应用相互平行排列的包含第一球 131 的喷头和包含第二球 141 的喷头通过喷墨同时形成第一和第二衬垫料。

在固化之前，固体 132 和 142 为液态形式的热固性粘结剂。例如，固体包括有机丙烯酸、聚氨酯以及环氧化合物、或有机硅化合物中至少之一。丙烯酸化合物的特定的例子可包括甲基丙烯酸乙酯、甲基丙烯酸正丁酯、甲基丙烯酸异丁酯、甲基丙烯酸二环戊酯、丙烯酸苯甲酯、甲基丙烯酸缩水甘油酯、甲基丙烯酸 2-羟乙酯、甲基丙烯酸烯酸、甲基丙烯酸异冰片酯、苯乙烯单体以及它们的聚合物。总之，可单独应用丙烯酸化合物或其结合。

可用做衬垫料材料的溶剂的沸点必须为 60 至 300°C。例如，可将乙二醇醚用作该溶剂。可应用的乙二醇醚的例子包括丙二醇甲醚(PGME)、二丙二醇甲醚(DGME)、三丙二醇甲醚(TGME)、丙二醇甲醚乙酸酯(PGMEA)、二丙二醇甲醚乙酸酯(DGMEA)、丙二醇正丙醚(PGPE)、二丙二醇正丙醚(DGPE)、丙二醇正丁醚(PGBE)、二丙二醇正丁醚(DGBE)、三丙二醇正丁醚(TGBE)、丙二醇苯醚(PGPE)、丙二醇二乙酸酯(PGD)、二丙二醇二甲醚(DGDE)、二乙二醇乙醚(DGEE)、二乙二醇甲醚(DGME)、二乙二醇正丁醚(DGBE)、二乙二醇己醚(DGHE)、二乙二醇正丁醚乙酸酯(DGBEA)、乙二醇丙醚(EGPE)、乙二醇正丁醚(EGBE)、乙二醇己醚(EGHE)、乙二醇正丁醚乙酸酯(EGBEA)、三乙二醇甲醚(TGME)、三乙二醇乙醚(TGEE)、三乙二醇正丁醚(TGBE)、乙二醇苯醚(EGPE)以及乙二醇正丁醚混合物(EGBEM)。

优选情况下，在室温下，例如 18~25°C 下，溶剂的表面张力为 20 至 80 达因/厘米 (dynes/cm)，粘度为 1 至 30cP 并且密度为 0.8 至 1.2 g/cc。基于这些性

质，在大约 80 至 300°C 的固化过程中，溶剂蒸发并被去除。

另外，第一球 131 和第二球 141 是由诸如二乙烯基苯的有机化合物制成的。在各个喷头中第一球 131 和第二球 141 与固体 132 和 142 和溶液能够区分开，从而形成第一衬垫料 130 和第二衬垫料 140，在其中，球表现为白色粉末的形式，而固体 132 和 142 以及溶剂是液态的。如果需要，第一球 131 以及第二球 141 在与其他衬垫料材料混合以前经过表面处理，从而可以将它们与其他液体组分区分开。

如上所述，第一衬垫料 130 和第二衬垫料 140 可形成于第二定向膜 204 上。作为另一种选择，相反的，在第一衬垫料 130 和第二衬垫料 140 形成于涂覆层 203 或公共电极上之后，第二定向膜 204 可形成于包括第一衬垫料 130 和第二衬垫料 140 的涂覆层 203 或公共电极上。

第一衬垫料 130 和第二衬垫料 140 具有在黑矩阵层 201 的宽度范围内的二维类椭圆形状。即是，越靠近衬垫料的中心，相应的球 131 或 141 的数量增加，以及，另一方面，越靠近衬垫料的边缘，相应的球 131 或 141 的数量减少。第一固体 132 和第二固体 142 防止喷射在要形成第一衬垫料 130 和第二衬垫料 140 形成的部分中的第一球 131 和第二球 141 不是聚集而是扩散。从而，第一固体 132 和第二固体 142 起到将第一球 131 和第二球 141 固定在第二定向膜 204 或涂覆层 203 上的作用。第一衬垫料 130 和第二衬垫料 140 为类椭圆形，其原因在于它们喷射为液态并因此部分地扩散。

这里，第一衬垫料 130 的功能为保持第一基板 100 和第二基板 200 之间的盒间隙。因为第二衬垫料 140 比第一衬垫料 130 短，所以只有在提供预定外部压力时，第二衬垫料 140 与第一基板 100 上提供的结构的最外顶表面（例如 第一定向膜 116）接触。因此，第二衬垫料 140 与第一衬垫料 130 一起抵抗外部压力，从而，防止由于压力仅集中在第一衬垫料 130 上引起的塑性变形。因此，可以避免由于塑性变形导致的挤压缺陷。

第一衬垫料 130 包括具有球形的球 131，并且，具有与第一基板 100 上提供的结构的最外上表面相接触的点状（dot-like）的窄接触区域。由于这些原因，当发生第一基板 100 或第二基板 200 被向一个方向推的触摸操作时，能够减小衬垫料和相对基板之间的摩擦力。这就使该基板很容易地还原到其最初状态并从而防止触摸缺陷。

其间,如图2至4中所示,滤色片层202可与黑矩阵层201一起排列在像素区域中。在一些情况下,滤色片层202可选择性地只排列在像素区域中,或者在由黑矩阵层201提供的部分中与黑矩阵层201部分地重叠或完全地重叠。

图6示出了LCD器件的触摸缺陷、重力缺陷和液晶余量之间的关系,其中在LCD器件中采用了含有相同尺寸的球的衬垫料。图7示出了LCD器件的触摸缺陷、重力缺陷和液晶余量之间的关系,其中LCD器件采用了具有不同尺寸的球的衬垫料。

更具体地说,图6示出了应用 $3.0\ \mu\text{m}$ 统一尺寸的球形成衬垫料的情况下的缺陷等级的表。如可从图6中看到的,在液晶量在大约131至134点(dot)的范围内,如131、132、133或134点的情况下,触摸缺陷和重力缺陷都接近零,并且不存在显示缺陷。另外,如可证实的那样,当液晶的总量小于131点时,触摸缺陷极大地增加,而当液晶的总量超过134点时,重力缺陷将增加。在这些情况下,将具有 $3.0\ \mu\text{m}$ 统一尺寸球的衬垫料以每子像素1个的密度排列。这样计算的液晶余量对应于 3.02% ($\frac{4}{(131+134)/2}$)。

另一方面,图7所示为根据本发明的液晶显示器中,分别在第一衬垫料130和第二衬垫料140中的第一球131和第二球141的直径为 $2.75\ \mu\text{m}$ 和 $2.5\ \mu\text{m}$,并将第一衬垫料130排列为每20个子像素1个的比率,第二衬垫料排列为每20个子像素16个的比率。在这种情况下,在大约117至127点的液晶的范围内,例如,在11个液晶点范围内,触摸缺陷和重力缺陷为零。这一大约117至127点的范围称为液晶余量。即是,当液晶的总量小于大约117点时,触摸缺陷增加,并且,当液晶的总量超过127点时,重力缺陷增加。这里计算的液晶余量对应 9.02% ($\frac{11}{(117+127)/2}$)。

图6和图7示出了1点为 4.0mg ,测试模型为23"的情况下的试验结果。如图6和图7中所示的结果看出的,与应用相同尺寸的衬垫料相比,应用不同尺寸的衬垫料时,液晶余量增加了大约6%。

在图6和图7的试验中,应用数量分别为8 wt%和4 wt%的第一固体132的液态热固性粘结剂和第二固体142的液态热固性粘结剂。在这种情况下,分别根据与其混合的第一球131和第二球141的尺寸,控制第一固体132和第二固体142的液态热固性粘结剂的含量,并随着球的直径的增加该含量增加。

同时,作为第一衬垫料130和第二衬垫料140,第一固体132和第二固体

142 与分别包含在其中的第一球 131 和第二球 141 一起,防止构成各衬垫料的球由于他们过大的直径而突出,并以聚合形式固定多个球。更具体地说,固体 132 和 142 防止球的移动,平滑衬垫料 130 和 140 的表面,并防止对衬垫料 130 和 140 或第一定向膜 116 的损坏。因此,当提供球衬垫料时,可防止由定向膜或衬垫料受损坏引起的明亮缺陷 (bright defect)。

已经参照图 2 至 5 说明根据本发明采用共平面开关模式的液晶显示器件的例子。在将上述的第一和第二衬垫料应用于 TN 模式的液晶显示器的情况下,可能获得与例子中相同的效果,其中像素电极形成在各个像素,并且公共电极进一步形成在第二基板上。

从上述可明显看出,根据本发明的液晶显示器及其制造方法具有下述优点:

首先,提供有球的衬垫料形成于基板上,从而,减小球和相对基板之间的接触区域。因此,当其上形成有球的基板发生相对于相对基板沿一方向受到推动的触摸操作时,可以减小衬垫料和相对基板之间的摩擦力。这样使得基板迅速恢复到其初始状态,并从而允许防止触摸缺陷。结果,可以防止在触摸后恢复之前发生的触摸缺陷。

第二,应用包含直径相互不同的球的第一衬垫料和第二衬垫料。更确切的说,具有更大直径的第一衬垫料起为维持盒间隙的作用,而具有较小直径的第二衬垫料只有当预定外部压力施加到其上时,才与相对的基板相接触。因此,第二衬垫料与第一衬垫料一起抵抗外部压力,从而,防止由于压力集中到一个衬垫料上引起塑性变形而导致的挤压缺陷的发生。

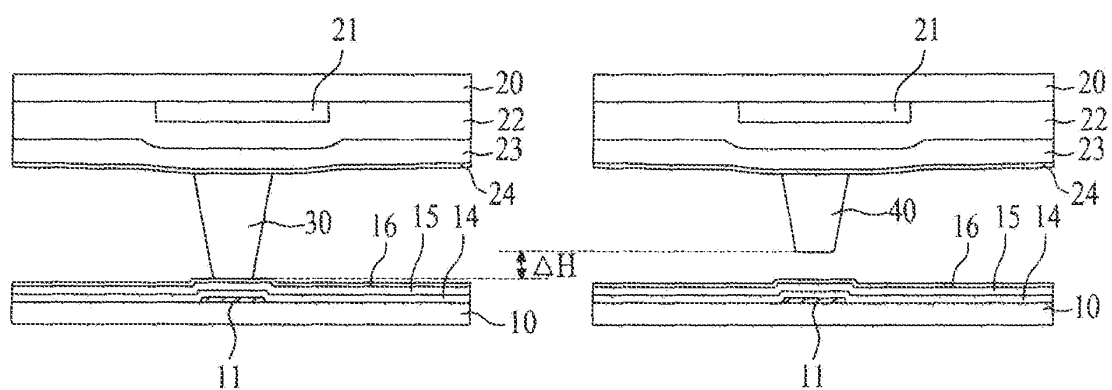
第三,与采用相同尺寸的衬垫料维持盒间隙的情况相比,通过应用形成不同高度的第一和第二衬垫料,可以增加液晶余量,同时避免触摸缺陷和重力缺陷。即,当液晶量小于用于第一基板和第二基板之间的间隙必需的预定级别时,发生触摸缺陷。当液晶量超过预定级别时,发生重力缺陷。液晶余量是指既不发生触摸缺陷又不发生重力缺陷的液晶量的范围。与维持间隙的第一衬垫料相比,通过增加与相对基板分隔开的第二衬垫料的排布率,可以减小触摸和重力缺陷的灵敏性。

第四,制备除了包括多个球之外还包括固体和溶剂的衬垫料的材料,以减小球的流动性 (mobility)。通过喷墨喷头将衬垫料材料喷射到期望的区域,并随后固化以形成衬垫料。因此,衬垫料中没有球突出并具有光滑的表面,这能够

防止球和相对表面之间的摩擦以及因此产生的损坏。此外，尽管它们与相对基板具有较小的接触区域，但是包括固体可以使提供球的衬垫料固定。

第五，采用不同尺寸的球状衬垫料以开发喷墨衬垫料工艺，从而，提高液晶余量。此外，控制用于防止挤压的衬垫料密度，以减小挤压强度。同时，控制固体含量，防止用于防止挤压的衬垫料突出，并从而降低明亮缺陷（bright defect）。

显然，对于熟悉本领域的技术人员来说在不脱离本发明精神或范围的情况下，对本发明可以进行各种修改和变形。从而，本发明意在覆盖落入所附权利要求书及其等同物范围内的本发明的修改和变形。



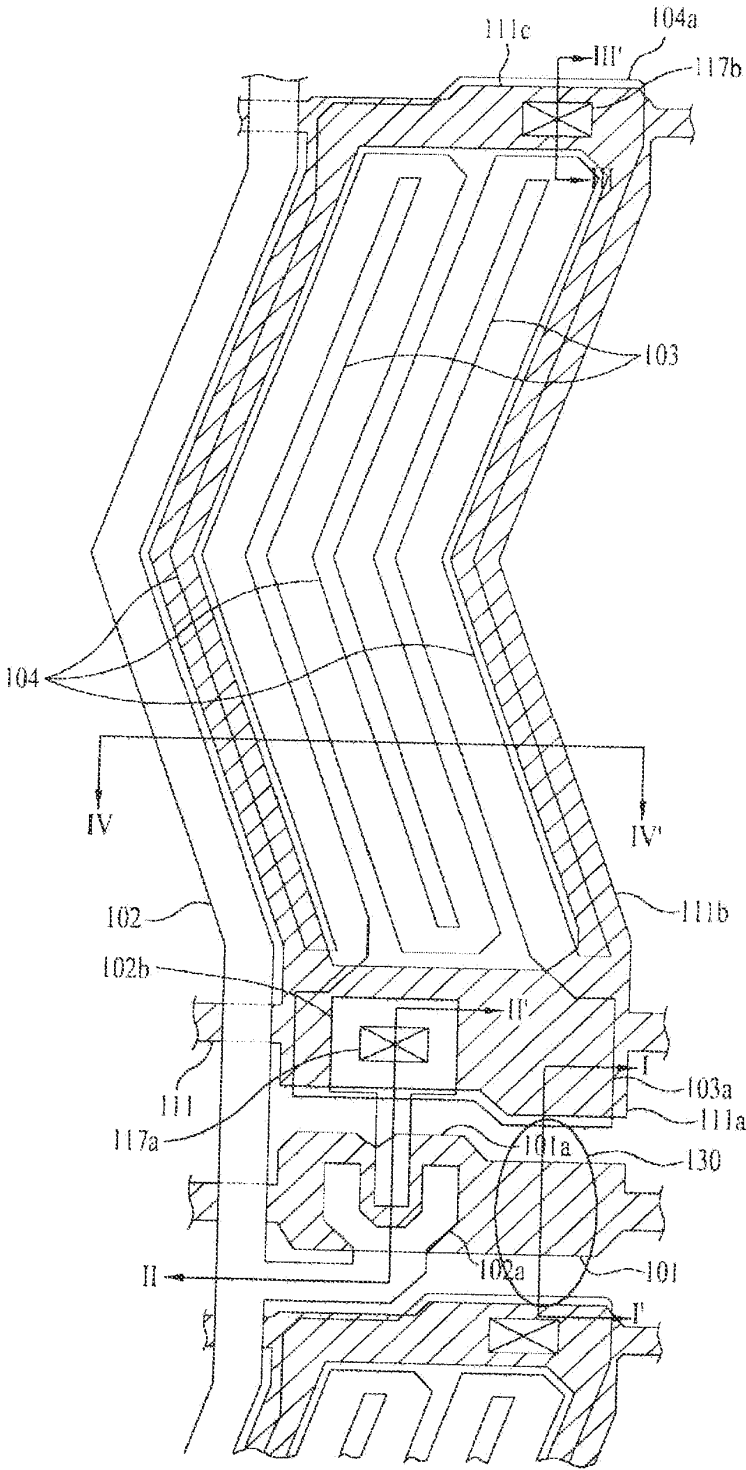


图 2

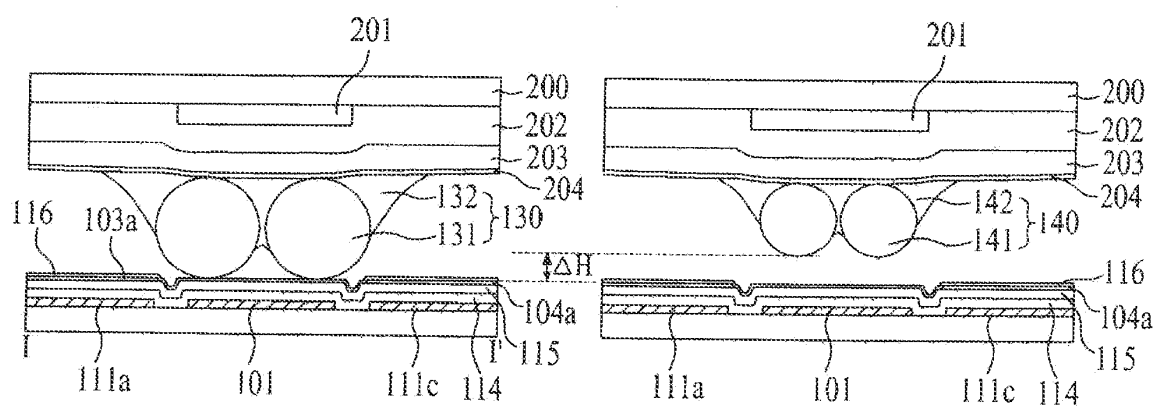
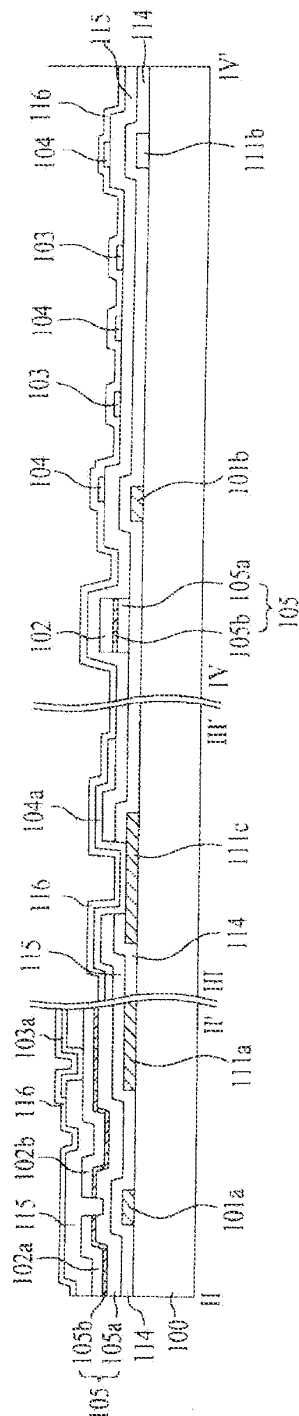


图 3



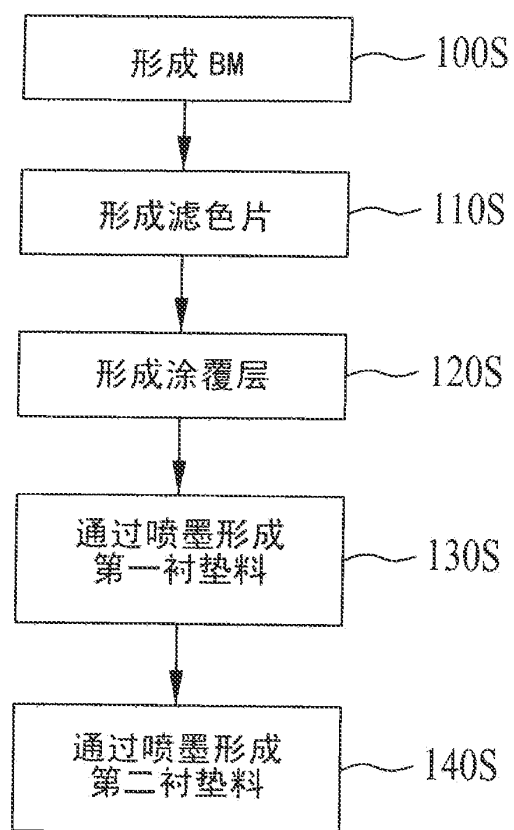


图 5

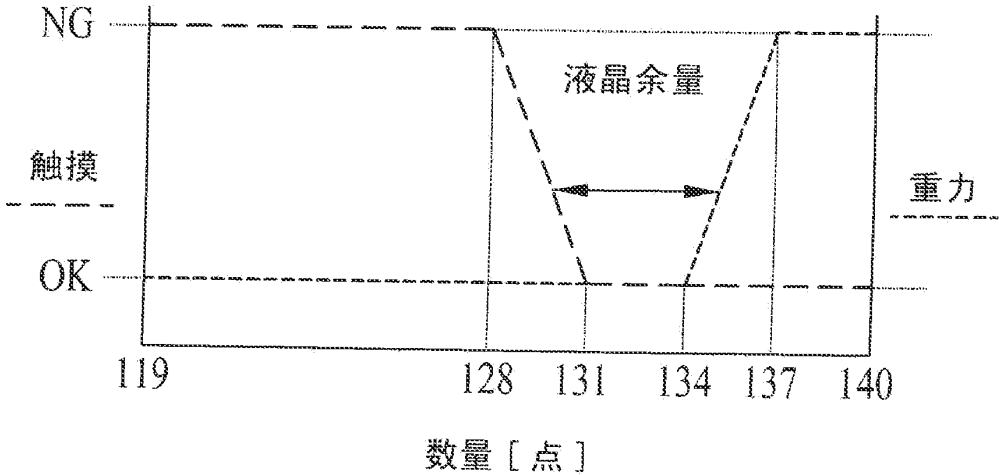


图 6

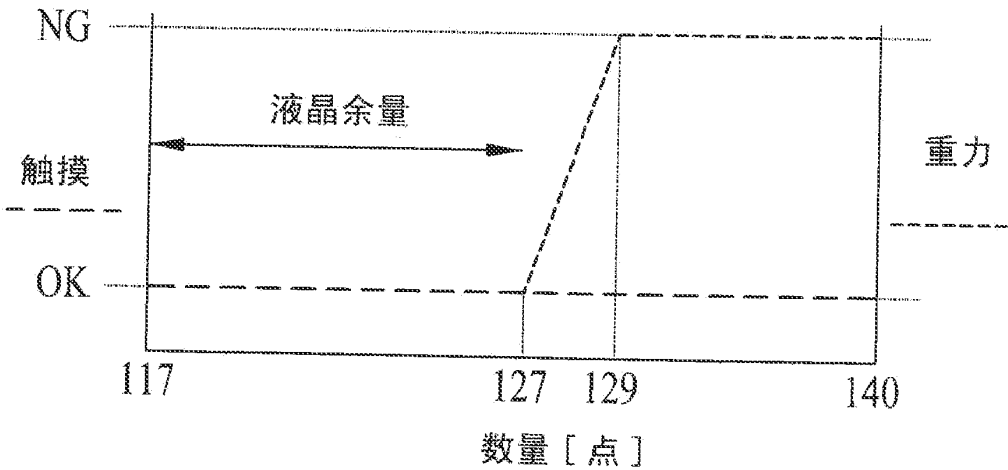


图 7



(12) 发明专利申请

(10) 申请公布号 CN 105511665 A

(43) 申请公布日 2016.04.20

(21) 申请号 201510649357.7

(22) 申请日 2015.10.09

(30) 优先权数据

10-2014-0136858 2014.10.10 KR

(71) 申请人 三星显示有限公司

地址 韩国京畿道

(72) 发明人 李相旭 金昌玉 梁成勳 任俊模

(74) 专利代理机构 北京英赛嘉华知识产权代理有限公司 11204

代理人 王达佐 刘铮

(51) Int. Cl.

G06F 3/041(2006.01)

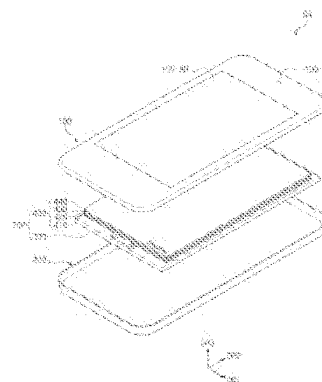
权利要求书1页 说明书15页 附图10页

(54) 发明名称

显示设备及制造显示设备的方法

(57) 摘要

公开了一种显示设备及制造显示设备的方法,该显示设备包括显示图像的显示部分、显示部分上的触摸部分,触摸部分包括显示部分上的第一导电层、第一导电层上的下无机层、覆盖下无机层的上无机层以及上无机层上的第二导电层。上无机层包括与下无机层大体上相同的材料。上无机层具有比下无机层的氢原子百分率小的氢原子百分率。



CN 105511665 A

1. 一种显示设备,包括:
显示图像的显示部分;以及
所述显示部分上的触摸部分,所述触摸部分包括:
所述显示部分上的第一导电层;
所述第一导电层上的下无机层;
覆盖所述下无机层的上无机层;以及
所述上无机层上的第二导电层,
其中所述上无机层包括与所述下无机层大体上相同的材料,以及
所述上无机层具有比所述下无机层的氢原子百分率小的氢原子百分率。
2. 如权利要求 1 所述的显示设备,其中所述上无机层的所述氢原子百分率大于 0 且小于或等于 20。
3. 如权利要求 2 所述的显示设备,其中所述上无机层包括氮化硅。
4. 如权利要求 3 所述的显示设备,其中所述第二导电层包括铜。
5. 如权利要求 2 所述的显示设备,其中所述下无机层具有等于或大于 5MV/cm 的击穿电压。
6. 如权利要求 5 所述的显示设备,其中所述下无机层具有比所述上无机层的厚度大的厚度。
7. 一种制造显示设备的方法,所述方法包括:
提供显示面板;
在所述显示面板上形成第一电极层;
在所述第一电极层上形成包括氮化硅的绝缘层;以及
在所述绝缘层上形成第二导电层,形成所述绝缘层包括:
在所述第一导电层上提供第一气体以形成下绝缘层;以及
在所述下绝缘层上提供第二气体以形成上绝缘层,以及
其中所述第一气体包括硅烷、氮气、氨气和氢气,以及所述第二气体包括硅烷、氮气和氢气。
8. 如权利要求 7 所述的方法,其中所述第二气体通过从所述第一气体中去除氨气而获得。
9. 如权利要求 8 所述的方法,其中:
所述下绝缘层具有超过 20 的氢原子百分率,所述下绝缘层的所述氢原子百分率大于所述上绝缘层的氢原子百分率,以及
所述上绝缘层具有大于 0 且小于或等于 20 的氢原子百分率。
10. 如权利要求 7 所述的方法,其中形成所述绝缘层在小于或等于 85°C 的温度执行。

显示设备及制造显示设备的方法

[0001] 相关申请的交叉引用

[0002] 于 2014 年 10 月 10 日提交至韩国知识产权局的、题目为“显示设备及制造显示设备的方法”的第 10-2014-0136858 号韩国专利申请通过引用整体并入本文。

技术领域

[0003] 实施方式涉及显示设备及制造显示设备的方法。

背景技术

[0004] 近年来,显示设备通常包括显示部分和触摸部分。触摸部分获得关于触摸事件发生的位置的坐标信息,并且将信息提供给显示部分。显示部分显示对应于从触摸部分提供的信息的图像。

发明内容

[0005] 实施方式针对于一种显示设备,该显示设备包括显示图像的显示部分、显示部分上的触摸部分,触摸部分包括显示部分上的第一导电层、第一导电层上的下无机层、覆盖下无机层的上无机层以及上无机层上的第二导电层。上无机层包括与下无机层大体上相同的材料。上无机层具有比下无机层的氢原子百分率小的氢原子百分率。

[0006] 上无机层的氢原子百分率可以大于 0 且小于或等于约 20。

[0007] 上无机层可以包括氮化硅。

[0008] 第二导电层可以包括铜。

[0009] 下无机层可以具有等于或大于约 5MV/cm 的击穿电压。

[0010] 下无机层可以具有比上无机层的厚度大的厚度。

[0011] 显示部分可以包括基衬底、基衬底上的有机发光二极管、以及基衬底上的薄膜封装层,薄膜封装层覆盖有机发光二极管并且包括无机材料。第一导电层直接位于薄膜封装层上。

[0012] 第一导电层可以包括薄膜封装层上的第一触摸电极,第一触摸电极在第一方向上延伸并且与第一方向相交的第二方向上布置。第二导电层可以包括分别与第一触摸电极相交并且通过上无机层和下无机层与第一触摸电极绝缘的第二触摸电极。

[0013] 每个第一触摸电极可以包括布置在第一方向上且彼此间隔开的第一感测部分、以及第一连接部分,每个第一连接部分位于第一感测部分之间,以连接在第一感测部分之中彼此邻近的两个第一感测部分。每个第二触摸电极可以包括布置在第二方向上且彼此间隔开的第二感测部分、以及第二连接部分,每个第二连接部分位于第二感测部分之间,以连接在第二感测部分之中彼此邻近的两个第二感测部分。

[0014] 第一导电层可以包括:薄膜封装层上的第一感测部分,第一感测部分布置在第一方向上并且彼此间隔开;薄膜封装层上的并且在第一方向上延伸的连接部分,每个连接部分连接在第一感测部分之中彼此邻近的两个第一感测部分;以及薄膜封装层上的第二感测

部分,第二感测部分在与第一方向相交的第二方向上布置、彼此间隔开、以及与第一感测部分和连接部分绝缘。第二导电层可以包括上无机层和下无机层上的桥电极,每个桥电极通过限定为穿过上无机层和下无机层的通孔而连接在第二感测部分之中彼此邻近的两个第二感测部分。

[0015] 实施方式还针对于一种制造显示设备的方法,该方法包括提供显示面板、在显示面板上形成第一电极层、在第一电极层上形成包括氮化硅的绝缘层、以及在绝缘层上形成第二导电层。形成绝缘层可以包括在第一导电层上提供第一气体以形成下绝缘层、以及在下绝缘层上提供第二气体以形成上绝缘层。第一气体可以包括硅烷、氮气、氨气和氢气,以及第二气体可以包括硅烷、氮气和氢气。

[0016] 第二气体可以通过从第一气体中充分地去除氨气而获得。

[0017] 下绝缘层可以具有超过约 20 的氢原子百分率,下绝缘层的氢原子百分率大于上绝缘层的氢原子百分率。上绝缘层可以具有大于 0 且小于或等于约 20 的氢原子百分率。

[0018] 形成绝缘层可以在小于或等于约 85°C 的温度执行。

[0019] 第一气体中的氢气的含量可以大于第二气体中的氮气的含量的约三倍。

[0020] 第二气体中的硅烷的含量小于第一气体中的硅烷的含量。

[0021] 显示面板可以包括基衬底、基衬底上的有机发光二极管、以及覆盖有机发光二极管的薄膜封装层,直接在薄膜封装层上形成第一导电层。

[0022] 形成第二导电层可以通过使用蚀刻溶液的湿法蚀刻工艺来执行。对上绝缘层的蚀刻速率可以是约 3 Å/s。

[0023] 形成第一导电层可以包括在薄膜封装层上形成第一电极使得第一电极在第一方向上延伸并且在与第一方向相交的第二方向上布置。形成第二导电层可以包括在上绝缘层上形成第二电极以与第一电极相交。

[0024] 第一导电层可以包括:薄膜封装层上的第一电极,第一电极在第一方向上延伸并且在与第一方向相交的第二方向上布置;以及位于第一电极之间的第二电极,第二电极在第二方向上彼此间隔开。形成第二导电层可以包括形成穿过上绝缘层和下绝缘层的通孔、以及在上绝缘层上形成连接电极,连接电极通过通孔连接第二电极。

附图说明

[0025] 通过参照附图详细地描述示例性实施方式,诸多特点对于本领域的技术人员而言将会变得显而易见,在附图中:

[0026] 图 1 说明了示出根据示例性实施方式的显示设备的装配立体图;

[0027] 图 2 说明了示出图 1 中所示的显示设备的分解立体图;

[0028] 图 3A 说明了示出根据示例性实施方式的显示部分的平面图;

[0029] 图 3B 说明了示出根据示例性实施方式的显示部分的剖视图;

[0030] 图 4A 说明了示出根据示例性实施方式的触摸部分的一部分的平面图;

[0031] 图 4B 说明了示出根据示例性实施方式的触摸部分的一部分的平面图;

[0032] 图 4C 说明了沿图 4B 的线 I-I' 截取的剖视图;

[0033] 图 5A 说明了示出根据另一示例性实施方式的触摸部分的一部分的平面图;

[0034] 图 5B 说明了示出根据示例性实施方式的触摸部分的一部分的平面图;

[0035] 图 5C 说明了沿图 5B 的线 II-II' 截取的剖视图；

[0036] 图 6 说明了示出根据示例性实施方式的制造显示设备的方法的流程图；以及

[0037] 图 7 说明了示出图 6 中所示的制造方法的一部分的流程图。

具体实施方式

[0038] 现在,将在下文中参照附图更充分地描述示例性实施方式;然而,它们可以以不同的形式实施并且不应被理解为限于在本文中所阐述的实施方式。更确切地说,提供这些实施方式以使得本公开将是彻底的和完整的,并将向本领域技术人员充分地传达示例性实现方式。

[0039] 在所绘附图中,为了说明的清楚性可以放大层和区域的尺寸。还将理解的是,当层或元件被称为在另一层或衬底“上”时,该层或元件可以直接在另一层或衬底上,或还可以存在介于中间的层。进一步地,将理解的是,当层被称为在两个层“之间”时,该层可以是这两个层之间的唯一的层,或者还可以存在一个或多个介于中间的层。贯穿全文,相同的参考数字指示相同的元件。

[0040] 将理解的是,虽然术语第一、第二等在本文中可用于描述各种元件、部件、区域、层和/或段,但是这些元件、部件、区域、层和/或段不应受这些术语限制。这些术语仅用于将一个元件、部件、区域、层或段与另一元件、部件、区域、层或段区分开。因此,在不背离本发明的教导的情况下,下文讨论的第一元件、部件、区域、层或段可称为第二元件、部件、区域、层或段。

[0041] 除非另有定义,否则本文所使用的所有术语(包括技术术语和科学术语)具有与相关领域的普通技术人员通常所理解的含义相同的含义。将进一步理解的是,多个术语诸如常用字典中所定义的那些术语应该被理解为具有与其在相关领域的上下文中的含义相一致的含义,并且除非本文明确地定义,否则不应以理想化的或过于正式的意义解释这些术语。

[0042] 图 1 说明了示出根据示例性实施方式的显示设备 DA 的装配立体图,以及图 2 说明了示出图 1 中所示的显示设备的分解立体图。

[0043] 参照图 1 和图 2,显示设备 DA 可以包括显示区 AR 和非显示区 BR,显示区 AR 和非显示区 BR 设置在由第一方向 DR1 和与第一方向 DR1 相交的第二方向 DR2 限定的平面上。

[0044] 显示区 AR 是其中显示图像 IM 的区域。用户可以从通过显示区 AR 所显示的图像 IM 获得信息。

[0045] 非显示区 BR 可以围绕显示区 AR 的边缘。非显示区 BR 可以限定显示区 AR。图像 IM 不在非显示区 BR 中显示。诸如按钮、输入端口等的外部输入装置可以进一步设置于非显示区 BR 中。

[0046] 显示设备 DA 可以包括上保护构件 100、下保护构件 200 以及触摸屏面板 TSP。上保护构件 100 和下保护构件 200 可以限定显示设备 DA 的外部形状。

[0047] 上保护构件 100 和下保护构件 200 可以耦接至彼此以保护触摸屏面板 TSP。上保护构件 100 和下保护构件 200 中的每个可以是塑料衬底、金属衬底、玻璃衬底或薄膜。

[0048] 上保护构件 100 可以覆盖触摸屏面板 TSP。上保护构件 100 可以包括传输区 100-AR 和非传输区 100-BR。

[0049] 传输区 100-AR 可以与显示区 AR 处于重叠的关系。传输区 100-AR 可以传输光使得图像 IM 被用户感知。用户可以通过传输区 100-AR 感知图像 IM。

[0050] 传输区 100-AR 可以由开口部限定或通过使用透明材料限定,其中光传输通过该透明材料。传输区 100-AR 可以传输图像 IM 以及可以保护显示设备 DA 的内部。

[0051] 非传输区 100-BR 可以围绕传输区 100-AR。非传输区 100-BR 可以具有框架形状。非传输区 100-BR 可以阻挡从触摸屏面板 TSP 提供的光。非传输区 100-BR 可以防止光行进至非显示区 BR。

[0052] 下保护构件 200 可以包括大体上与上保护构件 100 平行的平面和从平面弯曲至上方向 DR3 (下文中被称为第三方向) 的侧面。侧面可以从限定平面的面弯曲以围绕平面的边缘。

[0053] 平面和侧面可以限定预定的内部空间。下保护构件 200 可以在其内部空间中容纳触摸屏面板 TSP。侧面可以耦接于上保护构件 100 的边缘。

[0054] 触摸屏面板 TSP 可以包括显示部分 300 和触摸部分 400。显示部分 300 和触摸部分 400 可以在第三方向 DR3 上顺序地堆叠。

[0055] 显示部分 300 可以生成和显示图像 IM。显示部分 300 可以是例如响应于施加至其上的电压源而显示图像 IM 的显示面板。

[0056] 诸如液晶显示面板、有机发光显示面板、电泳显示面板、电润湿显示面板等的适合的显示面板可以用作显示部分 300。为了描述的方便,在本示例性实施方式中有机发光显示面板将描述为显示部分 300。

[0057] 当有机发光显示面板用作显示部分 300 时,显示部分 300 自身发光,而无需使用单独的光源。因此,显示设备 DA 可以是纤薄的和重量轻的。包括显示部分 300 的显示设备 DA 可以应用于移动设备、便携式设备或可以容易地在口袋中携带的柔性设备。

[0058] 触摸部分 400 可以感测外部触摸信息并将所感测的外部触摸信息作为输入信号施加至显示设备 DA。外部触摸信息可以通过可在上保护构件 100 上发生的用户的触摸产生。触摸部分 400 可以直接设置在显示部分 300 上。

[0059] 触摸部分 400 可以包括第一导电层 410、绝缘层 420、第二导电层 430 以及上层 440。第一导电层 410、绝缘层 420、第二导电层 430 以及上层 440 可以在第三方向 DR3 上顺序地堆叠。

[0060] 第一导电层 410 可以包括导电材料。例如,第一导电层 410 可以包括金属材料、导电氧化物、金属氧化物、导电聚合物及其合金中的至少一种。

[0061] 第二导电层 430 可以包括与第一导电层 410 相同的材料。作为示例,第二导电层 430 可以包括铜。

[0062] 第一导电层 410 和第二导电层 430 中的每个可以包括多个导电图案。第一导电层 410 的导电图案在与第二导电层 430 的导电图案相交的同时可以与第二导电层 430 的导电图案绝缘。导电图案可以具有多种形状。

[0063] 绝缘层 420 可以使第一导电层 410 与第二导电层 430 绝缘。绝缘层 420 可以包括无机材料。例如,绝缘层 420 可以包括氮化硅和氧化硅中的至少一种。例如,绝缘层 420 可以包括氮化硅。

[0064] 无机材料可以包括包含处于不同比例的氢原子的无机分子。例如,氮化硅除了包

括硅原子和氮原子之外可以包括氢原子。与硅原子相结合的氢原子的比例可以处于不同的组合。

[0065] 绝缘层 420 可以具有多层结构。在本示例性实施方式中,绝缘层 420 可以配置为包括一个堆叠在另一个上的至少两层。这两层可以包括大体上相同的无机材料。

[0066] 上层 440 可以是塑料衬底、玻璃衬底或薄膜。在一些实现方式中,上层 440 可以是光学薄膜,例如偏光板。在一些实现方式中,可以从触摸部分 400 省略上层 440。

[0067] 图 3A 说明了示出根据示例性实施方式的显示部分的平面图。图 3B 是示出根据示例性实施方式的显示部分的剖视图。在图 3A 和 3B 中,相同的参考数字指示图 1 和图 2 中的相同元件,并因此将不重复对相同元件的详细描述。

[0068] 参照图 3A,显示部分 300 可以包括像素区 300-AR 和外围区 300-BR,像素区 300-AR 和外围区 300-BR 设置在由第一方向 DR1 和第二方向 DR2 限定的平面上。

[0069] 像素区 300-AR 可以显示图像。像素区 300-AR 可以与显示区 AR 重叠。外围区 300-BR 可以围绕像素区 300-AR。

[0070] 显示部分 300 可以包括多个信号线 SGL、栅极驱动电路 GDC 以及多个像素 PX。信号线 SGL 可以配置为包括多个栅极线 GL 和多个数据线 DL。

[0071] 栅极线 GL 可以在第一方向 DR1 上延伸并且可以布置在第二方向 DR2 上。数据线 DL 可以在与栅极线 GL 相交的同时与栅极线 GL 绝缘。栅极线 GL 和数据线 DL 可以设置在像素区 300-AR 和外围区 300-BR 中。

[0072] 栅极驱动电路 GDC 可以设置在外围区 300-BR 中。栅极驱动电路 GDC 可以连接至栅极线 GL。栅极驱动电路 GDC 可以将扫描信号顺序地施加至栅极线 GL。

[0073] 栅极驱动电路 GDC 可以以多种方式设置。例如,栅极驱动电路 GDC 可以通过玻璃覆晶 (COG) 法或薄膜覆晶 (COF) 法安装在显示部分 300 上。栅极驱动电路 GDC 可以单独制备,并且随后耦接至显示部分 300。

[0074] 数据线 DL 可以设置在像素区 300-AR 中并且可以延伸至外围区 300-BR 中。数据焊盘 DL-P 可以设置在外围区 300-BR 中的数据线 DL 的一端。数据线 DL 可以通过数据焊盘 DL-P 接收数据信号。

[0075] 显示部分 300 可以连接至主电路 FPC-300。在图 3A 中,主电路 FPC-300 由虚线指示。

[0076] 主电路 FPC-300 可以包括数据驱动电路。主电路 FPC-300 可以连接至数据焊盘 DL-P 并且可以将数据信号施加至数据线 DL。

[0077] 另外,主电路 FPC-300 可以连接至栅极焊盘 GL-P。栅极焊盘 GL-P 可以设置在显示部分 300 中以邻近于数据焊盘 DL-P。

[0078] 栅极焊盘 GL-P 可以连接至栅极驱动电路 GDC。主电路 FPC-300 可以通过栅极焊盘 GL-P 将控制信号施加至栅极驱动电路。

[0079] 像素 PX 可以设置在像素区 300-AR 中。每个像素 PX 可以连接至栅极线 GL 中相应的栅极线和数据线 DL 中相应的数据线。

[0080] 像素 PX 可以响应于通过栅极线 GL 提供的扫描信号操作,以生成与通过数据线 DL 提供的的数据信号相对应的图像。

[0081] 图 3B 示出了显示部分 300 连同—个像素 PX 的剖视图。显示部分 300 可以包括基

衬底 310、器件层 320、显示层 330 和薄膜封装层 340。像素 PX 可以包括薄膜晶体管 TFT 和有机发光二极管 OLED。

[0082] 基衬底 310 可以是玻璃衬底、塑料衬底或薄膜。器件层 320 可以设置在基衬底 310 上。器件层 320 可以包括薄膜晶体管 TFT、第一绝缘层 IL1 和第二绝缘层 IL2。

[0083] 薄膜晶体管 TFT 可以包括控制电极 CE、半导体层 AL、输入电极 IE 和输出电极 OE。控制电极 CE 可以设置在基衬底 310 上。控制电极 CE 可以从与像素 PX 相对应的栅极线分出。

[0084] 第一绝缘层 IL1 可以设置在基衬底 310 上以覆盖控制电极 CE。第一绝缘层 IL1 可以覆盖控制电极 CE 和栅极线。第一绝缘层 IL1 可以包括无机材料和有机材料中的至少一种。第一绝缘层 IL1 可以具有单层或多层结构。

[0085] 半导体层 AL 可以设置在第一绝缘层 IL1 上。半导体层 AL 可以与控制电极 CE 处于重叠的关系。半导体层 AL 可以包括非晶硅、多晶硅或金属氧化物半导体。

[0086] 输入电极 IE 和输出电极 OE 可以设置在第一绝缘层 IL1 上并且彼此间隔开。数据线 DL 可以设置在第一绝缘层 IL1 上。输入电极 IE 可以从与像素 PX 相对应的数据线分出。

[0087] 输入电极 IE 和输出电极 OE 中的每个可以与半导体层 AL 的一部分处于重叠的关系。半导体层 AL 可以进一步包括设置于分别与输入电极 IE 和输出电极 OE 重叠的区域中的欧姆接触层。

[0088] 输入电极 IE 和输出电极 OE 可以彼此间隔开以暴露对应于输入电极 IE 和输出电极 OE 之间的距离的、半导体层 AL 的那一部分。

[0089] 第二绝缘层 IL2 可以设置在第一绝缘层 IL1 上以覆盖薄膜晶体管 TFT。第二绝缘层 IL2 可以将薄膜晶体管 TFT 与其他元件电绝缘。

[0090] 第二绝缘层 IL2 可以包括无机材料和有机材料中的至少一种。第二绝缘层 IL2 可以具有单层或多层结构。

[0091] 图 3B 示出了具有底栅结构的薄膜晶体管 TFT。在一些实现方式中，薄膜晶体管 TFT 可以具有顶栅结构、双栅结构或平面结构。

[0092] 显示层 330 可以设置在器件层 320 上。显示层 330 可以包括有机发光二极管 OLED 和像素限定层 PDL。有机发光二极管 OLED 可以包括第一电极 ED1、有机层 EL 和第二电极 ED2。

[0093] 第一电极 ED1 可以设置在第二绝缘层 IL2 上。第一电极 ED1 可以通过穿过第二绝缘层 IL2 所形成的通孔 TH 连接至输出电极 OE。

[0094] 第一电极 ED1 可以是透射式电极、半透半反射式电极或反射式电极。例如，当第一电极 ED1 是透射式电极时，第一电极 ED1 可以包括例如氧化铟锡 (ITO)、氧化铟锌 (IZO)、氧化铟锡锌 (ITZO) 等的透明金属氧化物。

[0095] 当第一电极 ED1 是半透半反射式或反射式电极时，第一电极 ED1 可以包括银 (Ag)、镁 (Mg)、铝 (Al)、铂 (Pt)、钯 (Pd)、金 (Au)、镍 (Ni)、钕 (Nd)、铱 (Ir)、铬 (Cr) 或其混合物。

[0096] 第一电极 ED1 可以具有单层结构或多层的层结构。例如，第一电极 ED1 可以具有氧化铟锡 (ITO)、银 (Ag) 或金属混合物的单层结构、氧化铟锡 / 镁 (ITO/Mg) 的双层结构、氧化铟锡 / 氟化镁 (ITO/MgF) 的双层结构、或氧化铟锡 / 银 / 氧化铟锡 (ITO/Ag/ITO) 的三层结构。

[0097] 像素限定层 PDL 可以设置在第二绝缘层 IL2 上。像素限定层 PDL 可以包括有机材料和无机材料中的至少一种。像素限定层 PDL 可以暴露第一电极 ED1 的至少一部分。

[0098] 有机层 EL 可以设置在第一电极 ED1 上。有机层 EL 可以覆盖第一电极 ED1 的、通过像素限定层 PDL 暴露的部分。有机层 EL 可以包括发光层,该发光层响应于施加至其上的电信号而产生光。

[0099] 发光层可以包括分别发出红色、绿色和蓝色的光的材料以及可以包括荧光材料或磷光材料。

[0100] 有机层 EL 可以具有单层结构或多层结构。当有机层 EL 具有多层结构时,可以提高发光二极管 OLED 的光效率。

[0101] 第二电极 ED2 可以设置在有机层 EL 和像素限定层 PDL 上。第二电极 ED2 可以设置于显示部分 300 的整个表面之上。

[0102] 第二电极 ED2 可以是透射式电极、半透半反射式电极或反射式电极。例如,第二电极 ED2 可以包括锂 (Li)、钙 (Ca)、氟化锂 / 钙 (LiF/Ca)、氟化锂 / 铝 (LiF/Al)、铝 (Al)、镁 (Mg)、银 (Ag) 或其化合物或混合物。

[0103] 第二电极 ED2 可以包括银 (Ag)、镁 (Mg)、铝 (Al)、铂 (Pt)、钯 (Pd)、金 (Au)、镍 (Ni)、钕 (Nd)、铱 (Ir)、铬 (Cr) 或其混合物,或者可以包括例如氧化铟锡 (ITO)、氧化铟锌 (IZO)、氧化锌 (ZnO)、氧化铟锡锌 (ITZO) 等的透明导电氧化物。

[0104] 第一电极 ED1 和第二电极 ED2 根据有机发光二极管 OLED 的发光类型可以包括不同的材料。例如,当有机发光二极管 OLED 是前表面发光类型时,第一电极 ED1 可以是反射式电极,以及第二电极 ED2 可以是透射式电极或半透半反射式电极。另一方面,当有机发光二极管 OLED 是后表面发光类型时,第一电极 ED1 可以是透射式电极或半透半反射式电极,以及第二电极 ED2 可以是反射式电极。

[0105] 薄膜封装层 340 可以设置在显示层 330 上。薄膜封装层 340 可以封装有机发光二极管 OLED。薄膜封装层 340 可以保护有机发光二极管 OLED 免受潮湿和氧化的作用。

[0106] 薄膜封装层 340 可以包括透明绝缘材料。薄膜封装层 340 可以包括有机材料和无机材料中的至少一种。薄膜封装层 340 可以进一步包括偏光板。

[0107] 薄膜封装层 340 可以具有单层或多层结构。当薄膜封装层 340 具有多层的层结构时,每一层具有约 1nm 至约 50nm 的厚度。可以通过薄膜封装层 340 封装显示部分 300,并因此显示设备可以是纤薄的。

[0108] 图 4A 说明了示出根据示例性实施方式的触摸部分的一部分的平面图,图 4B 是示出根据示例性实施方式的触摸部分的一部分的平面图,以及图 4C 是沿图 4B 的线 I-I' 截取的剖视图。

[0109] 在下文中,将参照图 4A 至 4C 对触摸部分 400 进行详细的描述。在图 4A 至 4C 中,相同的参考数字指示图 1 至图 3B 中的相同元件,并因此将不重复对相同元件的详细描述。在图 4A 至 4C 中,可以省略的上层 440(参照图 2)没有被示出。

[0110] 参照图 4A,触摸部分 400 可以直接设置在显示部分 300 上。第一导电层 410 可以设置在薄膜封装层 340 上。

[0111] 第一导电层 410 可以包括多个导电图案。导电图案可以包括在第一方向 DR1 上延伸且在第二方向 DR2 上布置的第一触摸电极 410a、410b、410c 和 410d。

[0112] 第一触摸电极 410a、410b、410c 和 410d 中的每个可以包括第一感测部分 TP1 和第一连接部分 CP1。第一感测部分 TP1 可以在第二方向 DR2 上布置并且彼此间隔开。第一连接部分 CP1 可以设置在第一感测部分 TP1 之间。每个第一连接部分 CP1 可以在第一方向 DR1 上连接彼此邻近的两个第一感测部分。

[0113] 第一导电层 410 可以进一步包括外部线 WP1。外部线 WP1 的一端可以连接至第一触摸电极 410a、410b、410c 和 410d。

[0114] 下部焊盘 PDD 可以限定在外部线 WP1 的另一端。下部焊盘 PDD 可以连接至稍后描述的第一焊盘 PD1。

[0115] 参照图 4B, 绝缘层 420 可以设置在第一导电层 410 上。绝缘层 420 可以覆盖第一导电层 410。第二导电层 430 可以设置在绝缘层 420 上。绝缘层 420 可以使第一导电层 410 与第二导电层 430 绝缘。

[0116] 第二导电层 430 可以包括多个导电图案。导电图案可以包括在第二方向 DR2 上延伸并且在第一方向 DR1 上布置的第二触摸电极 430a、430b 和 430c。

[0117] 第二触摸电极 430a、430b 和 430c 具有与第一触摸电极 410a、410b、410c 和 410d 大体上相似的结构。例如, 第二触摸电极 430a、430b 和 430c 可以配置为包括第二感测部分 TP2 和第二连接部分 CP2。

[0118] 第二感测部分 TP2 可以在第一方向 DR1 上布置并且彼此间隔开。当在平面图中观察时, 第二感测部分 TP2 可以设置在第一感测部分 TP1 之间, 不与第一感测部分 TP1 重叠。

[0119] 第二连接部分 CP2 可以设置在第二感测部分 TP2 之间。每个第二连接部分 CP2 可以在第二方向 DR2 上连接彼此邻近的两个第二感测部分 TP2。第二连接部分 CP2 可以设置为与第一连接部分 CP1 相交。第二连接部分 CP2 可以与第一连接部分 CP1 部分地重叠。

[0120] 第二导电层 430 进一步包括外部线 WP2。外部线 WP2 的一端可以分别连接至第二触摸电极 430a、430b 和 430c。外部线 WP2 的另一端可以延伸至焊盘区域 PA 中。

[0121] 第一焊盘 PD1 和第二焊盘 PD2 可以设置于焊盘区域 PA 中。第一焊盘 PD1 可以连接至第一导电层 410 的外部线 WP1 并且第二焊盘 PD2 可以连接至第二导电层 420 的外部线 WP2。

[0122] 通孔 420-TH 可以穿过绝缘层 420 形成。通孔 420-TH 可以与下部焊盘 PDD 重叠。第一焊盘 PD1 可以通过通孔 420-TH 电连接至下部焊盘 PDD。

[0123] 触摸驱动器可以向第一触摸电极 410a、410b、410c 和 410d 以及第二触摸电极 430a、430b 和 430c 施加感测信号。触摸驱动器包括信号施加器和信号处理器。

[0124] 信号施加器可以向第一触摸电极 410a、410b、410c 和 410d 或第二触摸电极 430a、430b 和 430c 顺序地施加感测信号。信号处理器可以感测感测信号的延迟值以感测触摸坐标。触摸驱动器可以直接安装在绝缘层 420 上或安装在用于触摸事件的单独的电路板上。

[0125] 参照图 4C, 绝缘层 420 可以包括第一绝缘层 421 和第二绝缘层 422。第一绝缘层 421 (在下文中, 称作下绝缘层) 可以设置在绝缘层 420 的下部。第二绝缘层 422 (在下文中, 称作上绝缘层) 可以设置在绝缘层 420 的上部。

[0126] 在本示例性实施方式中, 下绝缘层 421 可以提供绝缘层 420 的电耐久性, 以及上绝缘层 422 可以提供绝缘层 420 的物理耐久性。例如, 下绝缘层 421 可以提高绝缘层 420 的击穿电压, 以及上绝缘层 422 可以减小绝缘层 420 的蚀刻速率以提高绝缘层 420 对蚀刻溶

液的抵抗力。

[0127] 通常,随着层中的氢原子的数量变得更大,层的蚀刻速率增加。当层相对于蚀刻溶液具有高蚀刻速率时,层可能容易受到蚀刻溶液的伤害。当层相对于蚀刻溶液具有低蚀刻速率时,层对于蚀刻溶液可以是稳定的。因此,当绝缘层 420 被蚀刻时,绝缘层 420 的蚀刻速率可以对绝缘层 420 产生强烈的影响。

[0128] 上绝缘层 422 中的氢原子的比例可以比下绝缘层 421 中的氢原子的比例低。因此,上绝缘层 422 可以具有比下绝缘层 421 的蚀刻速率低的蚀刻速率。

[0129] 在本示例性实施方式中,氮化硅可以由指示氮原子可以变化的分子式 SiN_x 表示。因此,氢原子与硅原子的比例也会变化。例如,虽然氮化硅可以通过将氮原子与硅原子结合而获得的化合物,但是可以根据与氢原子结合的氮原子的数量加入氢原子。

[0130] 在本示例性实施方式中,包含于每个层中的氢原子的比例通过原子百分率(at%)表示。术语“原子百分率”指的是氢原子相对于包含于每个层中的各种原子的百分率。

[0131] 在根据本示例性实施方式的显示设备中,这样的绝缘层用作上绝缘层 422,在该绝缘层中氢原子的原子百分率小于下绝缘层 421 中的氢原子的原子百分率。因此,显示设备可以防止下绝缘层 421 在蚀刻过程期间被损坏。

[0132] 另外,特定层的击穿强度受到特定层的层密度影响。与上绝缘层 422 相比下绝缘层 421 可以具有相对高的层密度。

[0133] 下面的表 1 表示下绝缘层 421 和上绝缘层 422 与对比示例的比较。将参考下面的表 1 对绝缘层 420 进行详细的描述。

[0134] 表 1

[0135]

	氢的原子百分率(at%)	蚀刻速率(Å/s)	击穿电压(MV/cm)
第一对比示例	24.0	2.5	6.8
第二对比示例	36.8	316.2	2.9
下绝缘层	31.0	61.5	5.0
上绝缘层	19.6	1.8	2.4

[0136] 第一对比示例表示在约 370℃ 的高温形成的氮化硅层,第二对比示例表示在约 70℃ 的低温形成的氮化硅层,下绝缘层 421 包括在约 70℃ 的低温形成的氮化硅,以及上绝缘层 422 包括在约 70℃ 的低温形成的氮化硅。

[0137] 详细地,在功率约为 900W、沉积源和目标衬底之间的距离约为 500 密耳以及压力约为 1000 豪托的条件下形成下绝缘层 421。在这种情况下,用于沉积下绝缘层 421 的沉积气体包括约 1500sccm(标准立方厘米每分钟)的氮气(N_2)、约 500sccm 的氨气(NH_3)、约 150sccm 的硅烷气(SiH_4)以及约 4500sccm 的氢气(H_2)。

[0138] 在功率约为 500W、沉积源和目标衬底之间的距离约为 1000 密耳以及压力约为 500 豪托的条件下形成上绝缘层 422。在这种情况下,用于沉积上绝缘层 422 的沉积气体包括约 3000sccm 的氮气(N_2)、约 50sccm 的硅烷气(SiH_4)以及约 4500sccm 的氢气(H_2)。用于沉积

上绝缘层 422 的沉积气体不包括氨气 (NH_3)。

[0139] 如上所述,下绝缘层 421 和上绝缘层 422 具有不同的氢的原子百分率。表 1 中所示出的蚀刻速率表示针对与铜反应的蚀刻溶液的蚀刻速率。

[0140] 通常,在高温形成的氮化硅层相对于蚀刻溶液具有优良的稳定性,以及在低温形成的氮化硅层具有容易受到蚀刻溶液损坏的倾向。如表 1 所示,第一对比示例相对于蚀刻溶液具有约 $2.5 \text{ \AA/s}$ (埃每秒) 的相对低的蚀刻速率。

[0141] 第二对比示例相对于蚀刻溶液具有约 $316.2 \text{ \AA/s}$ 的相对高的蚀刻速率。当与第一对比示例比较时,因为第二对比示例容易与蚀刻溶液反应,所以在蚀刻铜的蚀刻过程期间第二对比示例可以容易被损坏。

[0142] 根据本示例性实施方式的上绝缘层 422 包括约 19.6at% 的氢原子。因此,上绝缘层 422 的蚀刻速率约为 $1.8 \text{ \AA/s}$,与第一对比示例的蚀刻速率类似。因此,上绝缘层 422 相对于蚀刻溶液具有优良的稳定性。

[0143] 详细地,上绝缘层 422 的氢原子的数量在大于约 0at% 且小于或等于约 20at% 的范围内。因此,上绝缘层 422 相对于与铜反应的蚀刻溶液具有小于或等于约 $3 \text{ \AA/s}$ 的蚀刻速率。根据本示例性实施方式的绝缘层 420 的蚀刻速率可以通过调节氢原子的原子百分率来控制。因此,可以提高绝缘层 420 的稳定性。

[0144] 参照表 1,下绝缘层 421 具有约 $61.5 \text{ \AA/s}$ 的蚀刻速率,该蚀刻速率低于第二对比示例的蚀刻速率,但高于第一对比示例的蚀刻速率。因此,下绝缘层 421 可以被蚀刻溶液轻微地损坏。

[0145] 根据实施方式的绝缘层 420 具有双层结构,该双层结构包括覆盖下绝缘层 421 的、具有相对低的蚀刻速率的上绝缘层 422。第二导电层 430 可以设置在上绝缘层 422 上,因此,下绝缘层 421 可以被上绝缘层 422 保护。第二导电层 430 可以在不损坏绝缘层 420 的情况下形成。因此,当制造显示设备时,可以提高绝缘层 420 的可靠性。

[0146] 与在低温形成的氮化硅层的击穿电压相比,在高温形成的氮化硅层可以具有相对高的击穿电压。术语“击穿电压”指的是最大电压,在该最大电压内欧姆定律保持有效,例如流过层的电流与施加至层的电压成比例。

[0147] 当高于击穿电压的电压施加至层时,忽略欧姆定律并且在层中出现雪崩现象,在该雪崩现象中极大的电流流过导体。因此,随着层的击穿电压变得更高,层对于电压的电耐久性变得更高。

[0148] 如表 1 所示,下绝缘层 421 的击穿电压约为 5.0 MV/cm (兆伏每厘米),与第一对比示例的击穿电压类似。与均具有约 2 MV/cm 的击穿电压的第二对比示例和上绝缘层 422 相比,下绝缘层 421 具有相对高的击穿电压。

[0149] 虽然未在表 1 中示出,但是与上绝缘层 422 相比,下绝缘层 421 具有相对更高的密度。通过控制在沉积下绝缘层 421 的过程中所使用的沉积气体,下绝缘层 421 可以比上绝缘层 422 更密地被沉积。

[0150] 通常,随着层的密度变得更高,层的内部缺陷变得更小并且击穿电压变得更高。因此,下绝缘层 421 具有比上绝缘层 422 的击穿电压高的击穿电压。下绝缘层 421 具有约 5 MV/cm 的击穿电压。

[0151] 根据本示例性实施方式的下绝缘层 421 具有比上绝缘层 422 的厚度大的厚度。绝缘层 420 可以包括具有比上绝缘层 422 的厚度大的厚度的下绝缘层 421。因此,绝缘层 420 可以具有高的击穿电压。因此,可以改善绝缘层 420 的电耐久性。

[0152] 图 5A 说明了示出根据另一示例性实施方式的触摸部分的一部分的平面图,图 5B 说明了示出根据该示例性实施方式的触摸部分的一部分的平面图,以及图 5C 说明了沿图 5B 的线 II-II' 截取的剖视图。在图 5A 至图 5C 中,相同的参考数字指示图 1 至图 4C 中的相同元件,并因此将不重复对相同元件的详细描述。

[0153] 参照图 5A,第一导电层 410-1 可以设置在薄膜封装层 340 上。第一导电层 410-1 可以包括第一感测部分 TP1、连接部分 CP1 以及第二感测部分 TP2。

[0154] 第一感测部分 TP1 可以在第二方向 DR2 上布置并且彼此间隔开。连接部分 CP1 可以设置在第一感测部分 TP1 之间。每个连接部分 CP1 可以在第一方向 DR1 上连接彼此邻近的两个第一感测部分。第一感测部分 TP1 和连接部分 CP1 可以对应于图 4A 中所示出的第一触摸电极 410a、410b、410c 和 410d。

[0155] 第二感测部分 TP2 可以在第一方向 DR1 上布置并且可以彼此间隔开。第二感测部分 TP2 可以与第一感测部分 TP1 和连接部分 CP1 电绝缘。第二感测部分 TP2 可以具有对应于图 4B 中所示出的第二感测部分 TP2 的形状的形状。

[0156] 第一导电层 410-1 可以进一步包括第一外部线 WP1 和第二外部线 WP2。第一外部线 WP1 可以连接至第一感测部分 TP1 中相应的第一感测部分,以及第二外部线 WP2 可以连接至第二感测部分 TP2 中相应的第二感测部分。

[0157] 第一外部线 WP1 和第二外部线 WP2 可以延伸至焊盘区域 PA 中。第一焊盘 PD1 可以设置于第一外部线 WP1 的、位于焊盘区域 PA 中的一端,以及第二焊盘 PD2 可以设置于第二外部线 WP2 的、位于焊盘区域 PA 中的一端。

[0158] 参照图 5B,绝缘层 420-1 和第二导电层 430-1 可以顺序地堆叠在第一导电层 410-1 上。绝缘层 420-1 包括多个绝缘图案。

[0159] 绝缘图案可以分别设置在第二感测部分 TP2 之间。绝缘图案可以与连接部分 CP1 处于重叠的关系。

[0160] 第二导电层 430-1 可以包括例如多个桥电极的多个导电图案。桥电极 430-1 可以设置在绝缘层 420-1 上并且可以在分别与连接部分 CP1 相交时分别与连接部分 CP1 绝缘。每个桥电极 430-1 可以通过穿过绝缘层 420-1 而形成的通孔连接第二感测部分 TP2 之中彼此邻近的两个第二感测部分,或可以沿着绝缘层 420-1 的侧表面连接第二感测部分 TP2 之中的两个第二感测部分。

[0161] 参照图 5C,绝缘层 420-1 可以与第一导电层 410-1 的一部分重叠。绝缘层 420-1 可以包括顺序地堆叠在第一导电层 410-1 上的下绝缘层 421-1 和上绝缘层 422-1。下绝缘层 421-1 和上绝缘层 422-1 可以包括与对于图 4C 中所描述的下绝缘层 421 和上绝缘层 422 的材料相同的材料。

[0162] 在这种情况下,下绝缘层 421-1 和上绝缘层 422-1 可以大体上同时图案化。因此,当在平面图中观察时,下绝缘层 421-1 和上绝缘层 422-1 具有相同的形状。下绝缘层 421-1 的侧表面可以与上绝缘层 422-1 的侧表面对齐。

[0163] 根据另一实施方式,绝缘层 420-1 可以整体地形成成为单一且单独的单元以覆盖第

一感测部分 TP1、连接部分 CP1 以及第二感测部分 TP2。

[0164] 根据另一实施方式,当在平面图中观察时,上绝缘层 422-1 可以具有比下绝缘层 421-1 的区域宽的区域。上绝缘层 422-1 可以覆盖下绝缘层 421-1 的上表面和侧表面,并因此可以防止下绝缘层 421-1 被损坏。

[0165] 图 6 说明了示出根据示例性实施方式的制造显示设备的方法的流程图,以及图 7 是示出图 6 中所示的制造方法的一部分的流程图。在下文中,将参照图 6 和图 7 对显示设备的制造方法进行详细的描述。在图 6 和图 7 中,相同的参考数字指示图 1 至图 5C 中的相同元件,并因此将不重复对相同元件的详细描述。

[0166] 显示设备的制造方法可以包括提供显示面板 (S100) 和形成触摸部分 (S200)。形成触摸部分 (S200) 可以包括形成第一导电层 (S210)、形成绝缘层 (S220) 以及形成第二导电层 (S230)。

[0167] 提供显示面板 (S100) 可以与触摸部分 (S200) 的形成分开地执行或相继地执行。例如,提供显示面板可以包括将制造的显示面板装载至真空室中或可以包括在真空室中形成显示面板后接着在真空室中形成触摸部分 (S200)。

[0168] 各种显示面板用作显示面板。例如,提供显示面板 (S100) 可以包括提供有机发光显示面板。有机发光显示面板可以包括基衬底、设置在基衬底上的有机发光二极管以及设置在有机发光二极管上的薄膜封装层。

[0169] 形成第一导电层 (S210) 可以包括在薄膜封装层上直接形成第一导电层。例如,第一导电层的形成 (S210) 可以包括在薄膜封装层上形成包括导电材料的基本层以及将基本层图案化以形成导电图案。可以通过使用蚀刻溶液的湿法蚀刻工艺执行形成第一导电层 (S210)。

[0170] 导电图案可以具有各种形状。例如,形成第一导电层 (S210) 可以提供图 4A 中所示出的第一导电层 410。导电图案可以包括第一触摸电极 410a、410b、410c 和 410d、外部线 WP1 以及下部焊盘 PDD。

[0171] 根据另一实施方式,形成第一导电层 (S210) 可以提供图 5A 中所示出的第一导电层 410-1。导电图案可以包括第一感测部分 TP1、第二感测部分 TP2、连接部分 CP1、外部线 WP 以及焊盘 PD1 和 PD2。包括在导电图案中的部分可以大体上同时形成或顺序地形成。

[0172] 形成绝缘层 (S220) 可以在第一导电层上提供包括氮化硅的绝缘层。绝缘层具有如图 4B 所示的适合于覆盖第一导电层的整个表面的形状。在一些实现方式中,绝缘层可以图案化为形成覆盖第一导电层的一部分的绝缘图案。

[0173] 如上所述,氮化硅是这样的化合物,在该化合物中硅原子与氮原子结合并且该化合物进一步包括氢原子。绝缘层可以包括以不同比例包含氢原子的氮化硅分子。

[0174] 可以通过在小于或等于约 85°C 的温度执行的低温沉积工艺来执行形成绝缘层 (S220)。例如,可以通过在约 70°C 的温度的等离子体增强化学气相沉积 (PECVD) 来执行绝缘层的形成 (S220)。当在低温执行绝缘层的形成 (S220) 时,可以防止包括在有机发光显示面板中的有机发光二极管被损坏。

[0175] 绝缘层的形成 (S220) 可以包括形成下绝缘层 (S221) 和形成上绝缘层 (S222)。可以使用不同气体执行形成下绝缘层 (S221) 和形成上绝缘层 (S222)。

[0176] 在形成下绝缘层 (S221) 时,可以供给第一气体以形成下绝缘层。第一气体可以包

括氮气 (N_2)、氨气 (NH_3)、硅烷气 (SiH_4) 以及氢气 (H_2)。硅烷气可以在真空室中与氮气反应以形成氮化硅。氮化硅可以沉积在第一导电层上以形成下绝缘层。

[0177] 氢气在第一气体中的比例可以相对高。在本示例性实施方式中, 可以以硅烷气在第一气体中的比例的三倍的量提供氢气。当沉积下绝缘层时, 氢气可以对下绝缘层施加物理影响。

[0178] 例如, 由于氢气使得悬空键在层中变得稳定。通常, 在通过低温沉积工艺形成的绝缘层中可能容易产生悬空键。在低温沉积工艺期间, 沉积材料的能量可比通过高温沉积工艺所形成的沉积材料的能量低。

[0179] 因此, 沉积材料可能在硅烷气硅原子最外层电子的一部分与空穴完全结合之前沉积。结果, 悬空键可能存在于层中。然而, 当第一气体包括处于高速率的氢气时, 可以实现悬空键钝化。

[0180] 另外, 在真空室中氢原子可与其他原子物理地碰撞。当沉积氮化硅分子时, 氢原子可与氮化硅分子物理地碰撞。由于物理碰撞, 所以可提高氮化硅分子的移动性。氮化硅分子可物理地分散, 并因此, 氮化硅分子可均匀地沉积在比较大的区域上而不是沉积在特定区域上。

[0181] 因此, 可以相对密地沉积氮化硅分子。当通过使用第一气体形成下绝缘层时, 可以防止在下绝缘层中形成例如空位的缺陷。因此, 可以形成具有相对高的密度的绝缘层。

[0182] 如上所述, 层的密度可以对层的击穿电压施加影响。当下绝缘层具有高密度时, 可以提高下绝缘层的击穿电压。因此, 在形成下绝缘层 (S221) 时使用第一气体所形成的绝缘层可以具有提高的电气性能。

[0183] 可以在形成下绝缘层 (S221) 后执行形成上绝缘层 (S222)。可以使用不同于第一气体的第二气体执行形成上绝缘层 (S222)。第二气体可以包括硅烷气 (SiH_4)、氮气 (N_2) 以及氢气 (H_2)。

[0184] 除了不包括氨气之外, 第二气体可以与第一气体大体上相同。第二气体可以提供比第一气体的氢原子比例相对小的氢原子比例。

[0185] 当氨气被除去或不存在时, 与在下绝缘层的形成 (S221) 时的情况相比, 硅烷原子和氢原子之间耦合的概率变低。因此, 在形成上绝缘层 (S222) 时, 形成具有氮化硅分子的绝缘层, 在该绝缘层中氢原子的数量相对低。在本示例性实施方式中, 上绝缘层可以包括约 20at% 或小于约 20at% 的氢原子。

[0186] 另外, 第二气体可以包括比第一气体中的硅烷气的比例相对低的比例的硅烷气。硅烷气在第二气体中的量可以比硅烷气在第一气体中的量小。因此, 上绝缘层可以具有比下绝缘层小的厚度。

[0187] 在本示例性实施方式中, 下绝缘层的击穿电压可以高于上绝缘层的击穿电压。在形成绝缘层 (S220) 时, 下绝缘层可以形成为具有比上绝缘层的厚度大的厚度。可以提高绝缘层的电耐久性。

[0188] 可以在形成上绝缘层 (S222) 后执行第二导电层的形成 (S230)。例如, 形成第二导电层 (S230) 可以包括在上绝缘层上形成包含导电材料的基本层以及将基本层图案化以形成导电图案。

[0189] 导电图案可以是图 4B 中所示出的导电图案。在这种情况下, 形成第二导电层

(S230) 可以包括形成第二触摸电极 430a、430b 和 430c、外部线 WP2 以及焊盘 PD1 和 PD2。

[0190] 在其他实现方式中，导电图案可以是图 5B 中所示出的导电图案。在这种情况下，第二导电层的形成 (S230) 可以包括形成桥电极。包括在导电图案中的部分可以通过将基本层图案化而大体上同时形成或顺序地图案化。

[0191] 可以通过使用蚀刻溶液的湿法蚀刻工艺执行形成第二导电层 (S230)。在本示例性实施方式中，第二导电层可以包括铜。因此，蚀刻溶液可以包括对于铜具有高反应性的材料。

[0192] 在第二导电层的形成 (S230) 时所使用的蚀刻溶液可以接触当图案化基本层时暴露的绝缘层。通常，蚀刻溶液对于通过低温沉积工艺所形成的氮化硅层可以具有高的反应性。通过低温沉积工艺所形成的氮化硅层可能处于在第二导电层的形成 (S230) 时容易被损坏的风险之中。

[0193] 根据本示例性实施方式的绝缘层具有双层结构，在该双层结构中上绝缘层覆盖下绝缘层。如上所述，上绝缘层可以包括约 20at % 或小于约 20at % 的氢原子。因此，针对于蚀刻溶液，上绝缘层的蚀刻速率可以仅为约 $3\text{\AA}/\text{S}$ 。

[0194] 根据本示例性实施方式的显示设备可以包括上绝缘层。可以防止绝缘层由于在第二导电层的形成 (S230) 时所使用的蚀刻溶液而被损坏。根据显示设备的制造方法，绝缘层可以通过低温沉积工艺形成。显示设备可以具有提高的可靠性。

[0195] 下绝缘层可以具有高的击穿电压并且可以被具有低的蚀刻速率的上绝缘层覆盖。因此，可以提高显示设备的电的和物理的耐久性。可以提高显示设备的可靠性，可以提高显示设备的产量，以及可以提高在显示设备的使用时的可靠性。

[0196] 经过总结和回顾，显示设备的触摸部分可以直接设置在显示部分上。在这种情况下，可能期望的是，在例如防止显示部分被损坏的环境下执行形成触摸部分的过程。

[0197] 实施方式提供了包括直接设置在显示部分上的触摸部分且具有提高了的耐久性和电性能的显示设备。

[0198] 实施方式提供了制造能够防止绝缘层在低温环境下被损坏的显示设备的方法。

[0199] 根据实施方式，通过制造方法制造的显示设备包括显示部分和触摸部分。触摸部分包括顺序地堆叠的第一和第二导电层以及设置在第一和第二导电层之间且配置为包括两层的绝缘层。绝缘层包括下层和上层，上层具有比下层的氢原子百分率低的氢原子百分率。

[0200] 因为上层具有低的氢原子百分率，所以针对于蚀刻溶液，上层的反应性变得更低，并因此使上层的蚀刻速率减小。因此，提高了绝缘层相对于在第二导电层的形成时所使用的蚀刻溶液的稳定性，以至于提高了显示设备的物理耐久性和产量。

[0201] 另外，因为下层具有比上层的密度高的密度，所以下层具有高的击穿电压。因此，虽然在低温执行显示设备的制造方法，但是提高了显示设备的电耐久性，并因此提高了显示设备的使用时的可靠性。

[0202] 在本文中公开了示例性实施方式，以及虽然使用了特定的术语，但是这些术语仅以一般的和描述性的意义使用和解释，并且不是为了限制的目的。在一些情况下，如本领域普通技术人员随着本申请的文件显而易见的，除非另外特别地指出，否则结合具体实施方式描述的特征、特性和 / 或元件可以单独地使用或与结合其他实施方式描述的特征、特性

和 / 或元件结合。因此,本领域的技术人员将理解的是,在不背离如所附权利要求中阐述的其精神和范围的情况下,可以做出形式和细节上的各种改变。

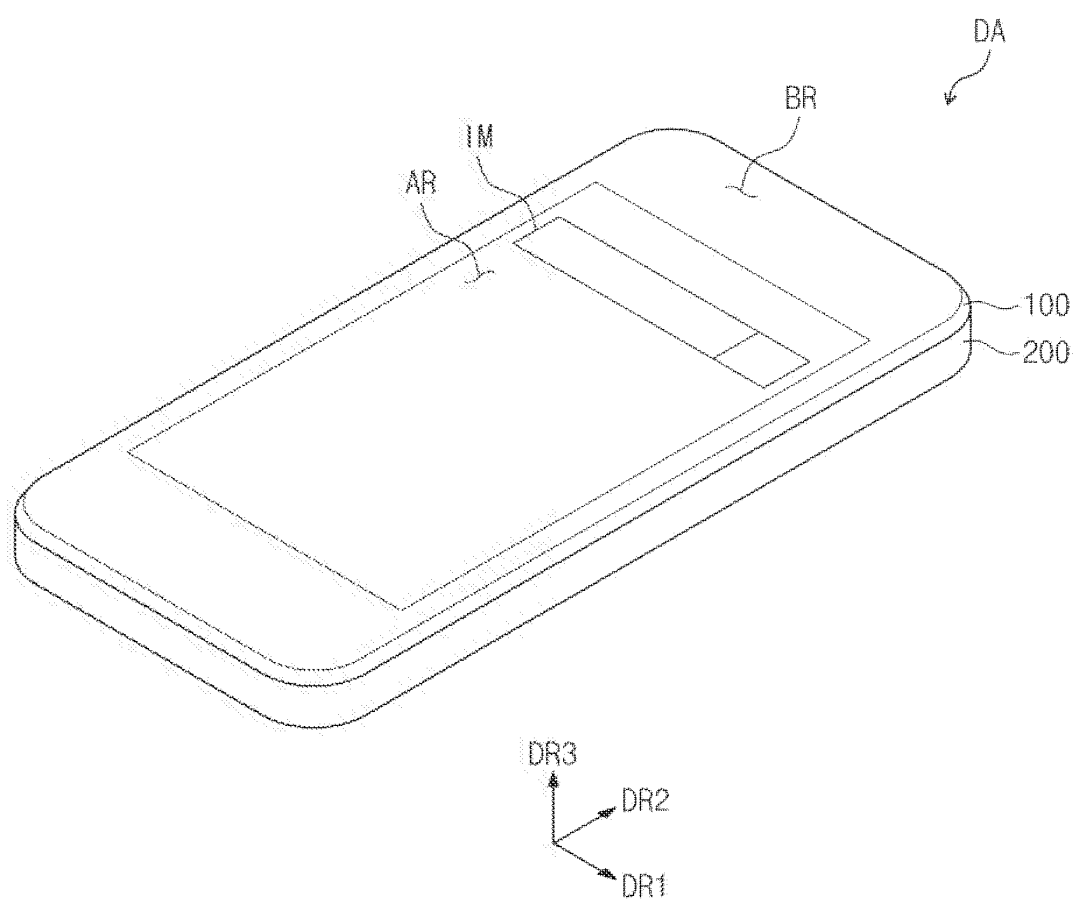


图 1

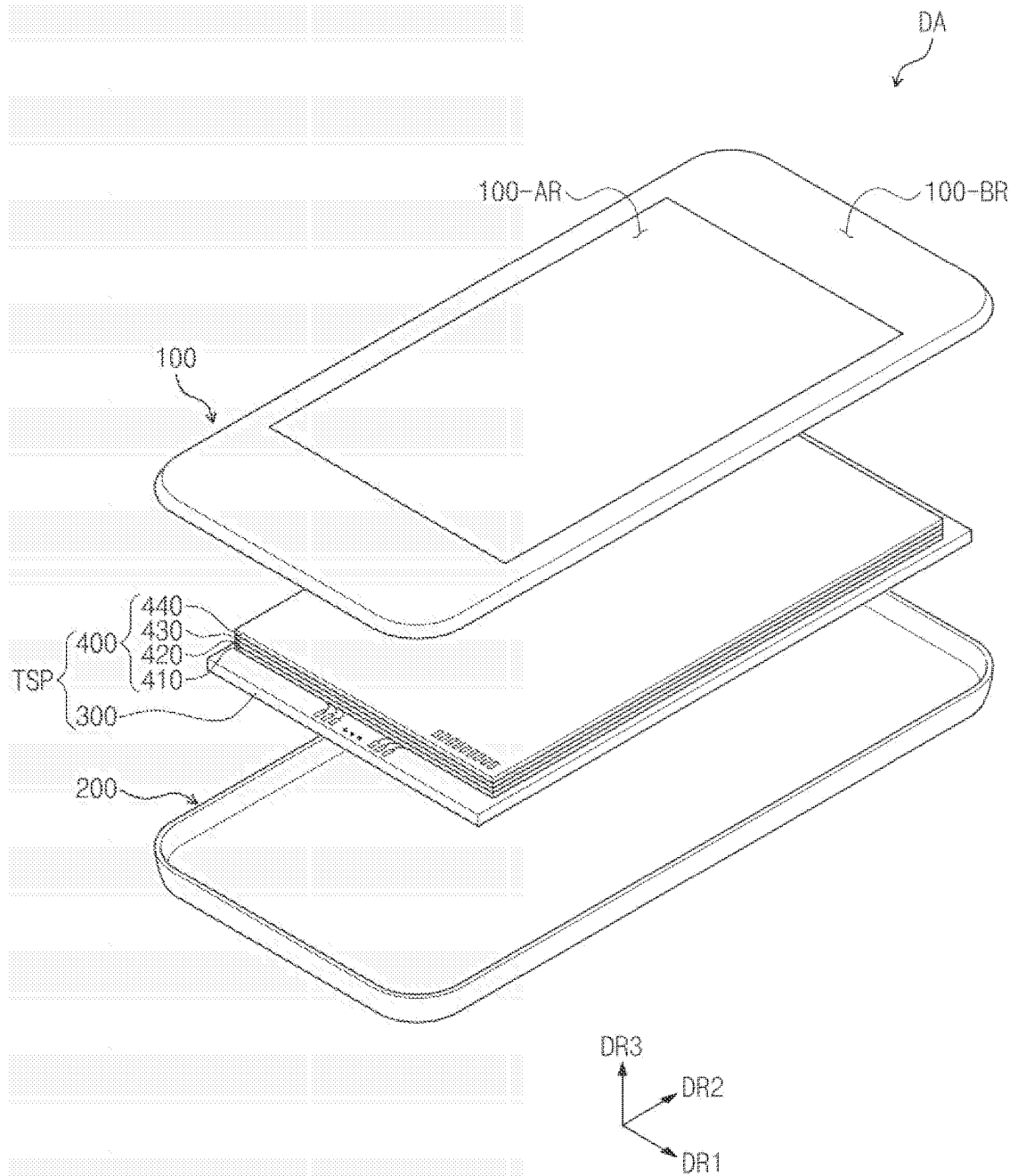


图 2

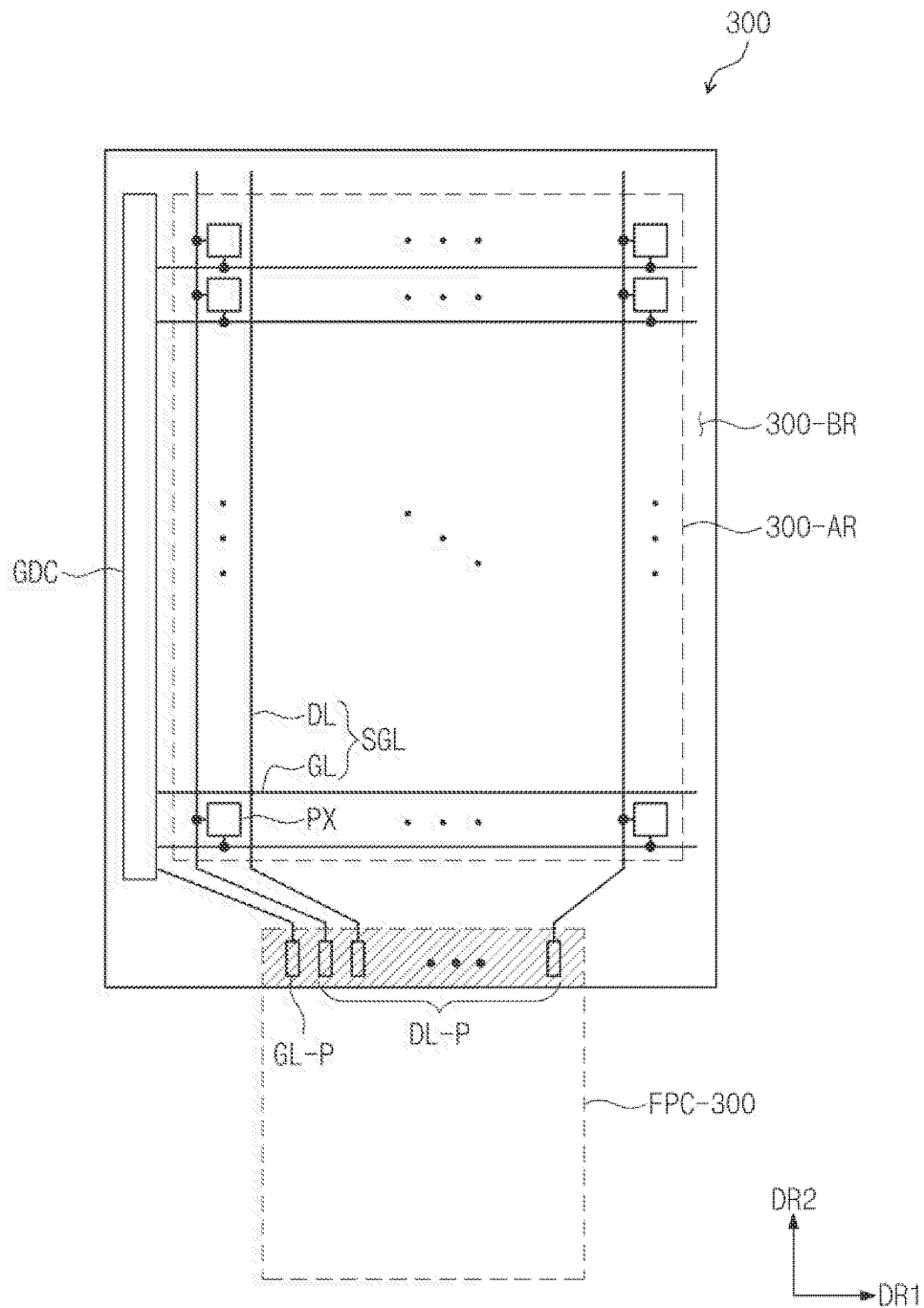


图 3A

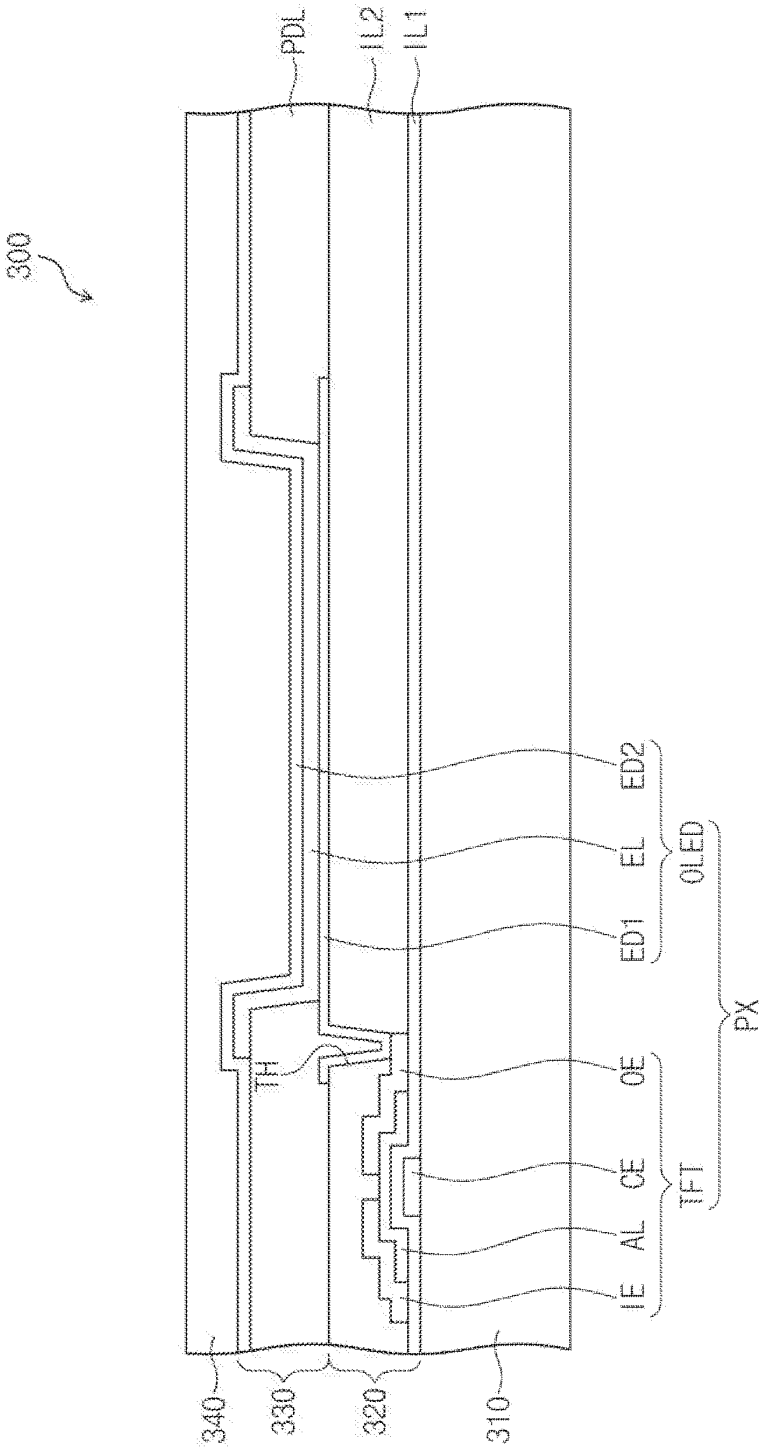


图 3B

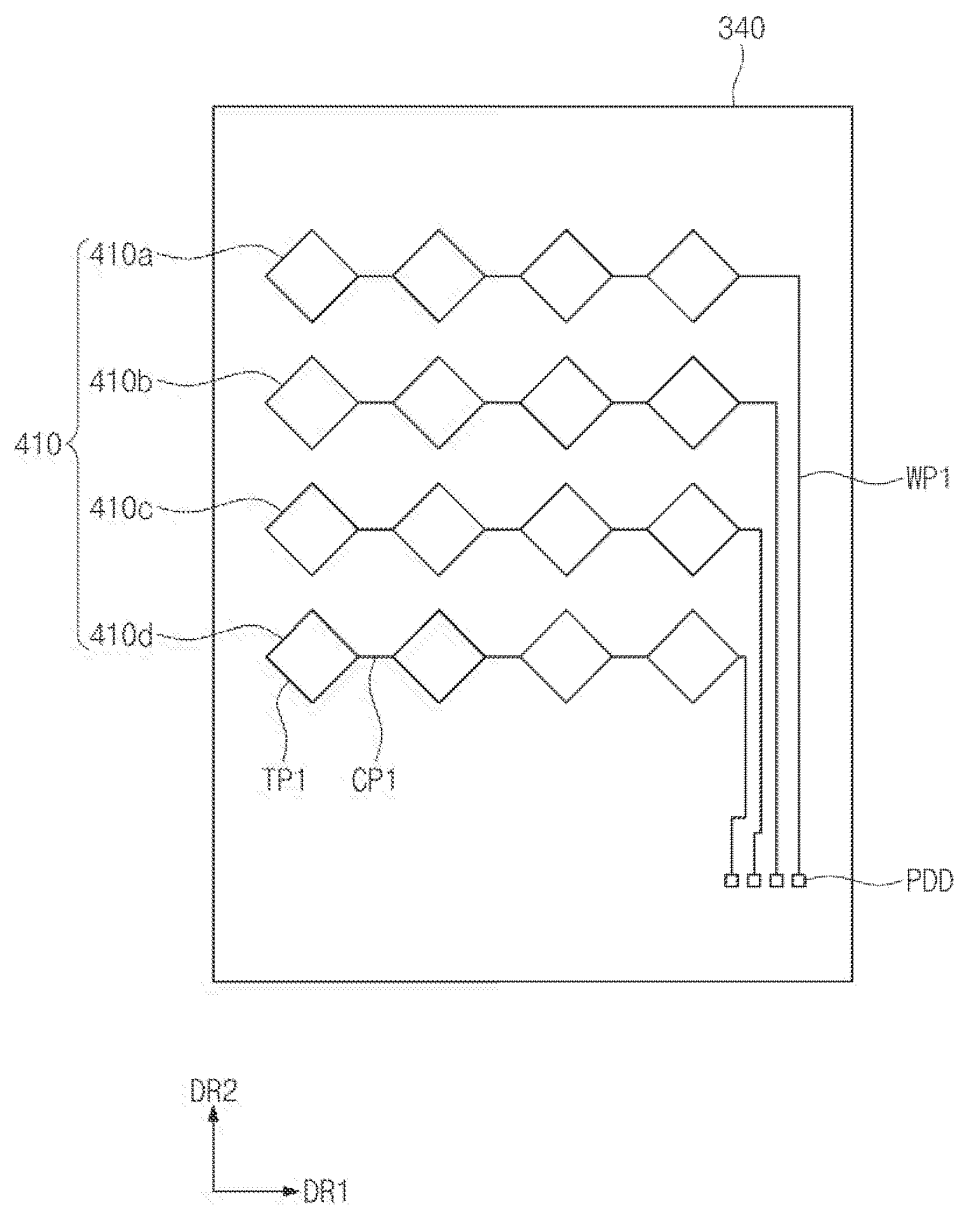


图 4A

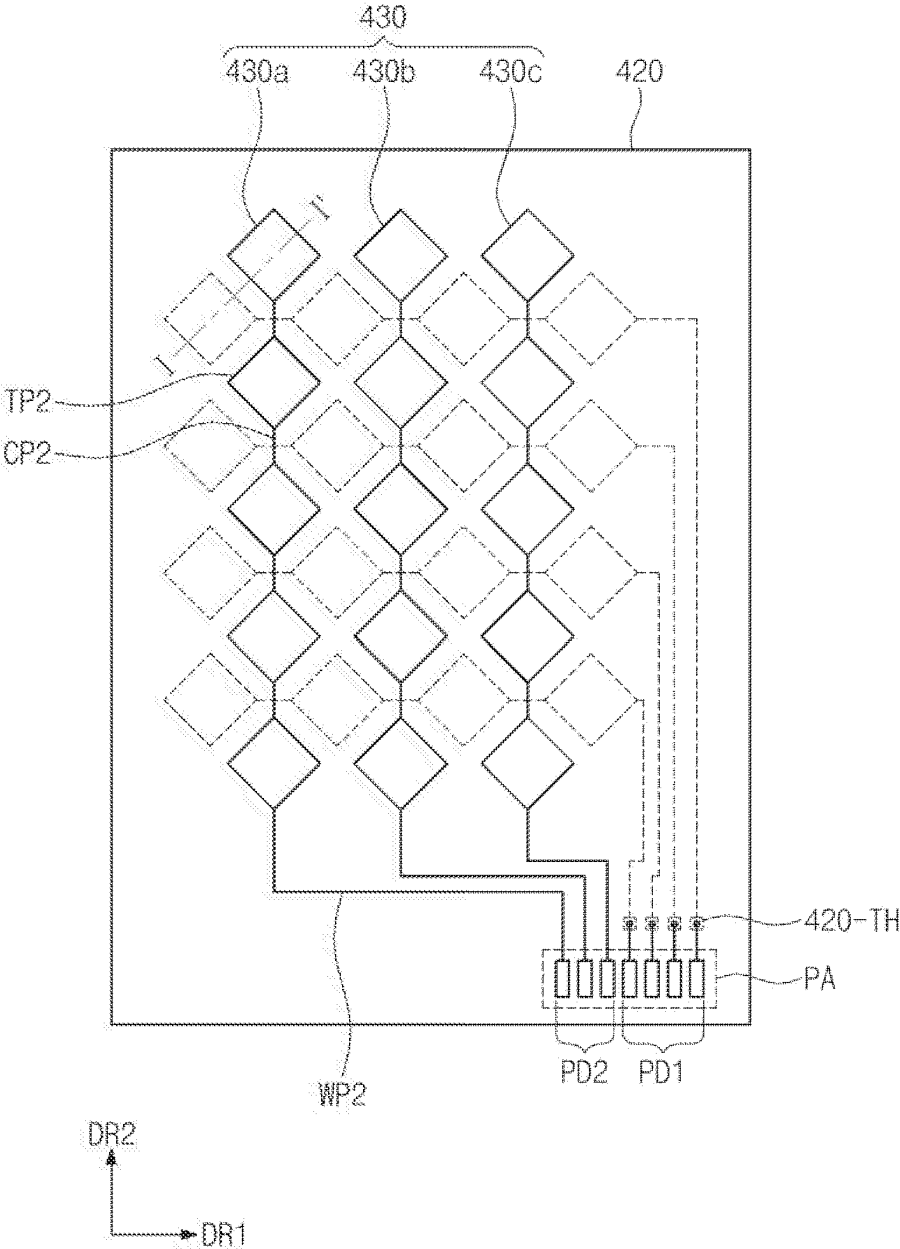


图 4B

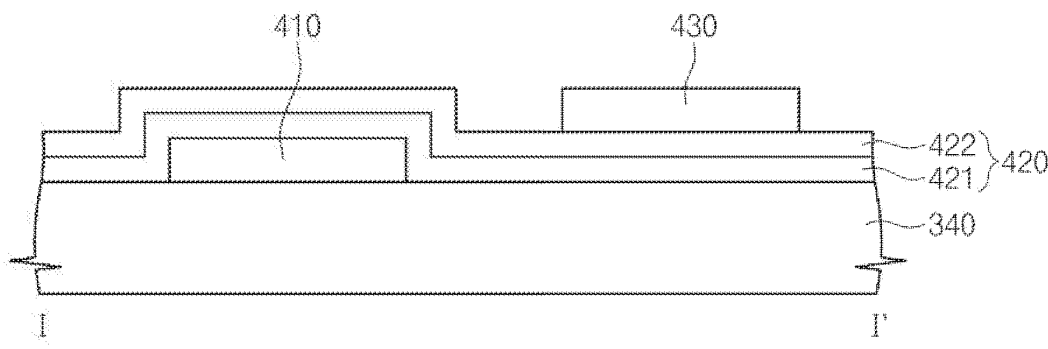


图 4C

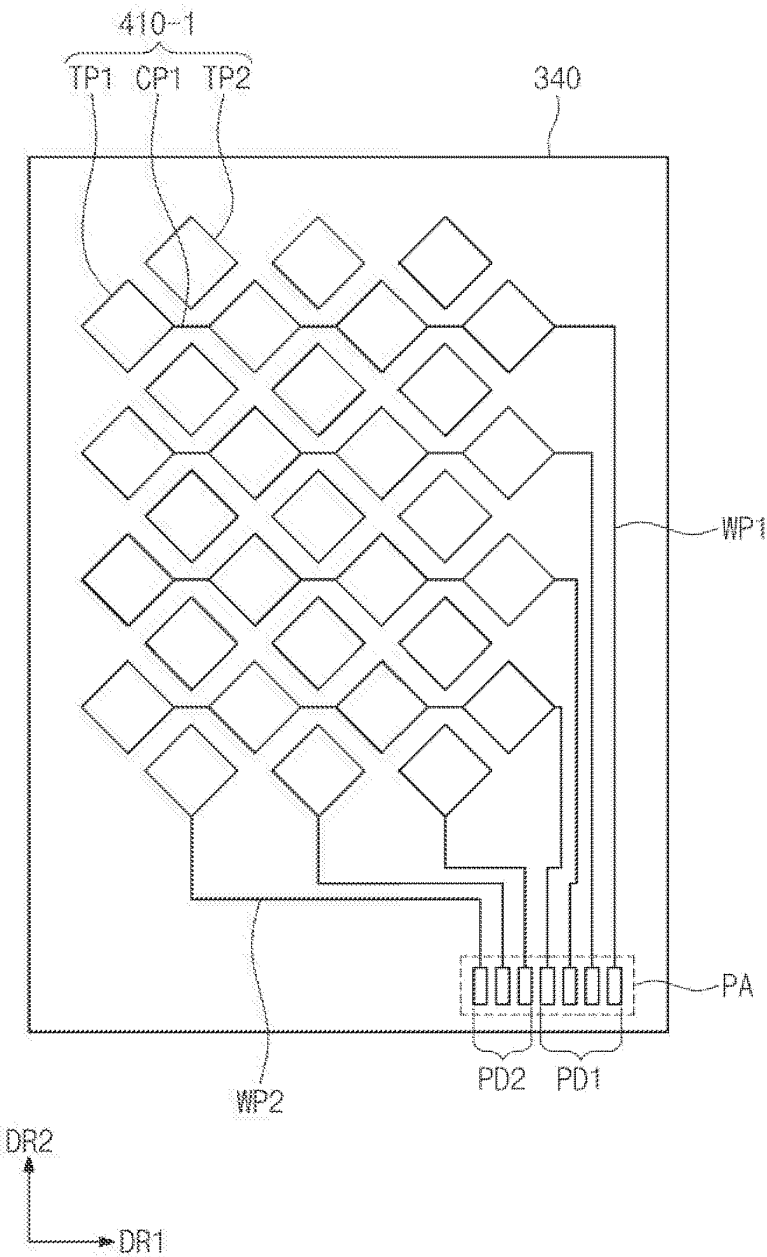


图 5A

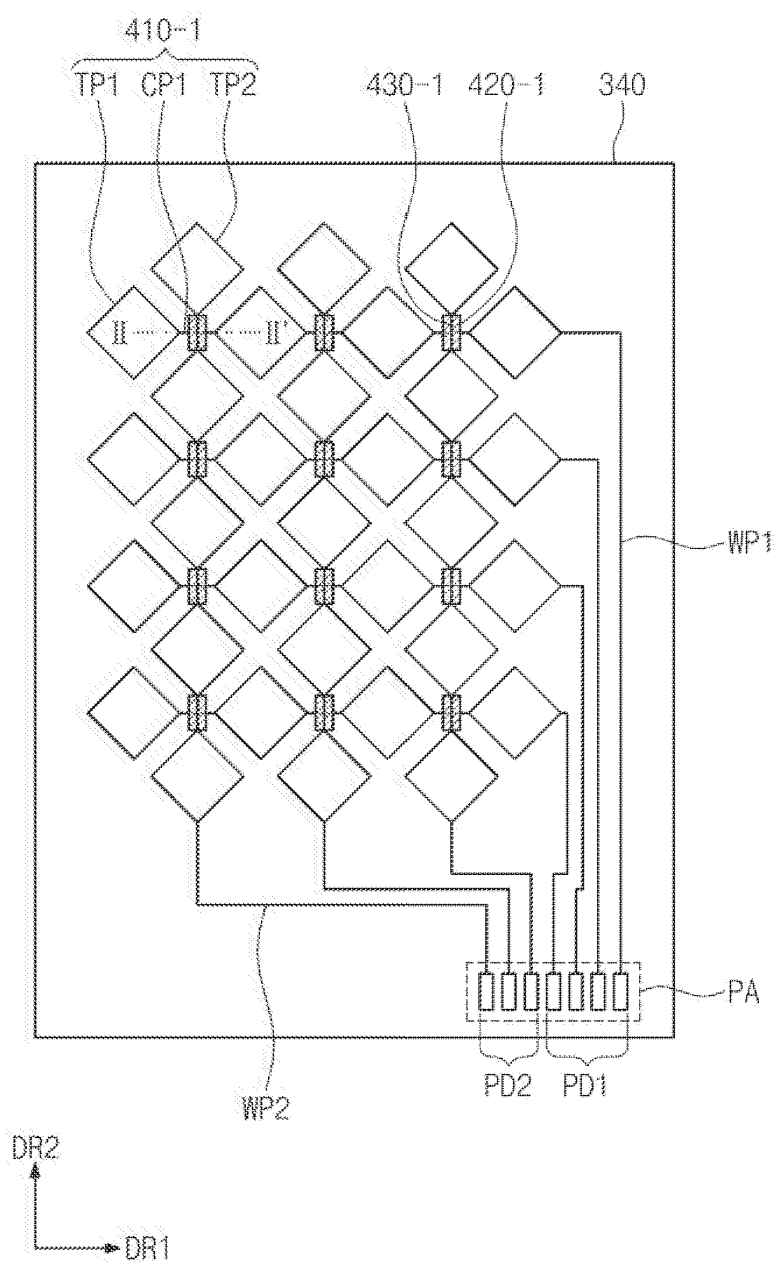


图 5B

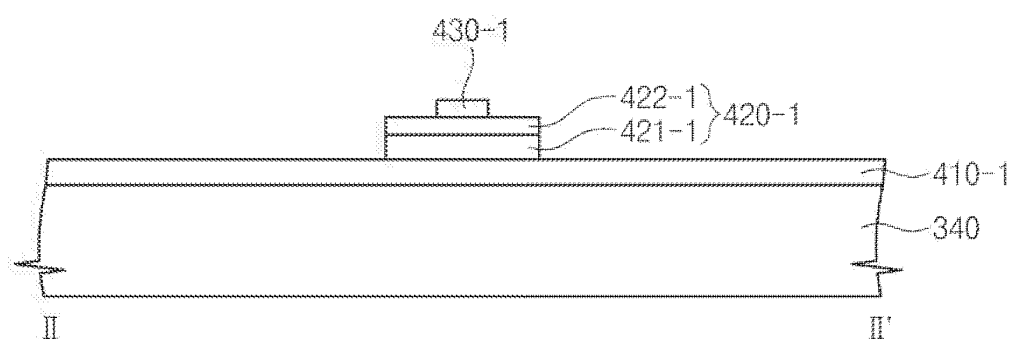


图 5C

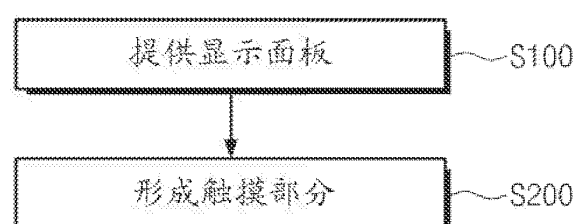


图 6

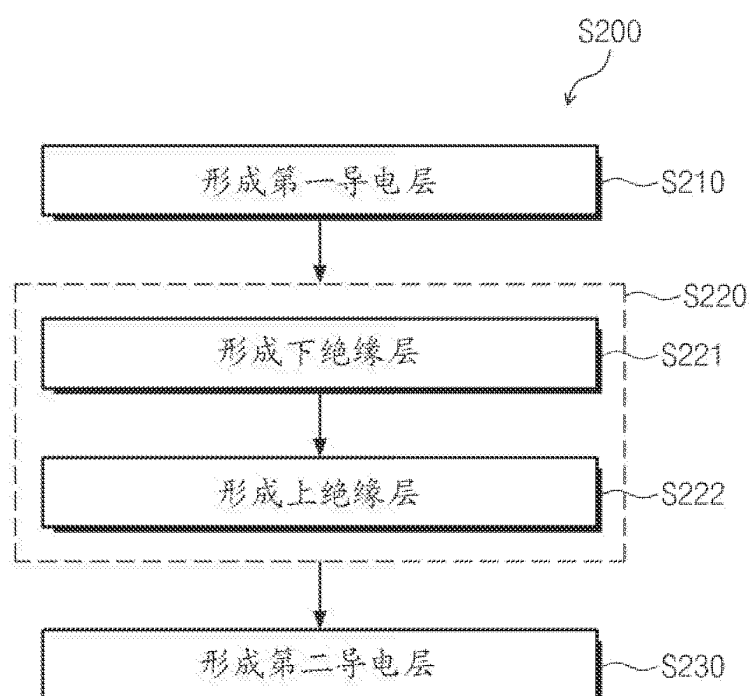


图 7

Electronic Patent Application Fee Transmittal				
Application Number:		16742230		
Filing Date:		14-Jan-2020		
Title of Invention:		DISPLAY DEVICE		
First Named Inventor/Applicant Name:		Chiwook AN		
Filer:		Ryan Matthew Swank/Sheila Harter		
Attorney Docket Number:		183539/411598-04552		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
Total in USD (\$)				260

Electronic Acknowledgement Receipt	
EFS ID:	42685773
Application Number:	16742230
International Application Number:	
Confirmation Number:	7917
Title of Invention:	DISPLAY DEVICE
First Named Inventor/Applicant Name:	Chiwook AN
Customer Number:	23363
Filer:	Ryan Matthew Swank/Sheila Harter
Filer Authorized By:	Ryan Matthew Swank
Attorney Docket Number:	183539/411598-04552
Receipt Date:	10-MAY-2021
Filing Date:	14-JAN-2020
Time Stamp:	19:34:09
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$260
RAM confirmation Number	E202150J34484509
Deposit Account	031728
Authorized User	Sheila Harter
<p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>37 CFR 1.21 (Miscellaneous fees and charges)</p>	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	183539Transmittal.pdf	115273	no	2
			fc8c85fd35731f24339800957d47d2cb48de4cc3		
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	183539SB08.pdf	106002	no	2
			e8be7c4da7fbfb6c13884345608e2a95606e6fec		
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Foreign Reference	CN588.pdf	26105862	no	29
			ece98d60466a7bc98c141a5a6d2f723cebbdca52		
Warnings:					
Information:					
4	Foreign Reference	CN665.pdf	24200574	no	27
			44a6ce8d5238f2a6cf2c1767dece405914833efc		
Warnings:					
Information:					
5	Foreign Reference	CN017Part1.pdf	12816533	no	15
			8c9da63a8079624ac7ccb4fa98c266b95f02a0fc		
Warnings:					
Information:					
6	Foreign Reference	CN017Part2.pdf	12831484	no	19
			44244bc48ffbc05f44640000c01b5224061ae9f		
Warnings:					

Information:					
7	Foreign Reference	CN221Part1.pdf	13169700	no	15
			7e98694ace80e3ea77d499bf07dec33eda8110bf		
Warnings:					
Information:					
8	Foreign Reference	CN221Part2.pdf	13660683	no	24
			00513ca76d4fd925b734866705b668f9a4938c21		
Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	30453	no	2
			d39fde409e7837558f7726e99d807334d9c7e945		
Warnings:					
Information:					
Total Files Size (in bytes):			103036564		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on May 10, 2021 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.

/Sheila R. Harter/
Sheila R. Harter

Inventor(s) : Chiwook An, et al. Confirmation No. 7917
Application No. : 16/742,230
Filed : January 14, 2020
Title : DISPLAY DEVICE

Grp./Div. : 2625
Examiner : Towfiq Elahl

Docket No. : 183539

**INFORMATION DISCLOSURE STATEMENT WITH FEE
UNDER 37 CFR §§ 1.97(d) AND 1.17(p)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
May 10, 2021

Commissioner:

In compliance with the duty of disclosure under 37 CFR §§ 1.56, 1.97 and 1.98, and in accordance with the provisions in the Manual of Patent Examining Procedure §§ 609 and 707.05(b), enclosed is an information disclosure statement listing the references that are known to applicant. Copies of each of the listed Foreign Patent Documents and Other Documents references are enclosed.

It is respectfully requested that the listed references be considered in the examination of this application and identified on the list of references cited on the patent issuing for this application. Applicant also requests that an initialed copy of the information disclosure statement be entered in the application file and returned to applicant with the next communication from the Office in accordance with MPEP § 609.

C:\NRPortbl\FIRM\RMS\114375978_1.docx

Application No. 16/742,230

Applicant's undersigned attorney hereby certifies, in accordance with 37 CFR § 1.97(e)(1), that each item of information contained in the information disclosure statement was first cited in a communication from any foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement.

The processing fee of \$260.00 as required by 37 CFR § 1.17(p) is submitted herewith. The Commissioner is hereby authorized to charge any fees which may be required by this paper to Deposit Account No. 03-1728. Please show our docket number with any Deposit Account transaction.

Respectfully submitted,

LEWIS ROCA ROTHGERBER CHRISTIE LLP

By /Ryan M. Swank/

Ryan M. Swank
Reg. No. 62,600
626/795-9900

RMS/srh

Enclosures: Information Disclosure Statement, w/references

[19] 中华人民共和国国家知识产权局



[12] 发明专利申请公布说明书

[21] 申请号 200910138692.5

[51] Int. Cl.

H01L 25/16 (2006.01)

H01L 27/32 (2006.01)

H01L 23/48 (2006.01)

H01L 23/12 (2006.01)

G09G 3/32 (2006.01)

[43] 公开日 2010年1月13日

[11] 公开号 CN 101626017A

[22] 申请日 2009.5.14

[21] 申请号 200910138692.5

[30] 优先权

[32] 2008.7.11 [33] US [31] 61/080,179

[32] 2009.1.7 [33] US [31] 12/350,101

[71] 申请人 三星移动显示器株式会社

地址 韩国京畿道

[72] 发明人 张亨旭

[74] 专利代理机构 北京德琦知识产权代理有限公司

代理人 罗正云 宋志强

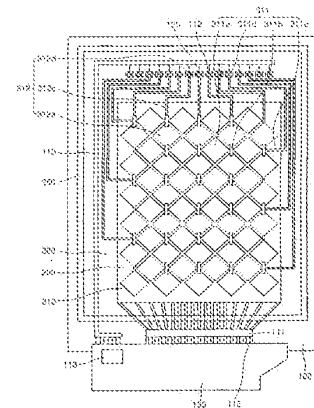
权利要求书6页 说明书16页 附图11页

[54] 发明名称

有机发光显示装置

[57] 摘要

本发明提供一种有机发光显示装置，该有机发光显示装置具有静电电容型触摸面板功能。在一实施例中，该有机发光显示装置包括：基板；在所述基板上的显示单元；具有面向所述基板的侧的封装基板；面向所述显示单元的触摸单元，该触摸单元包括彼此电连接并沿着第一方向在平行行中延伸的多个第一传感器，和彼此电连接并沿着与所述第一方向交叉的第二方向在平行列中延伸的多个第二传感器；以及在所述第一传感器和所述第二传感器的至少一部分上的绝缘层。



1、一种有机发光显示装置，包括：

基板（100）；

在所述基板（100）上的显示单元（200）；

具有面向所述基板（100）的侧的封装基板（300）；

面向所述显示单元（200）的触摸单元，该触摸单元包括：

彼此电连接并沿着第一方向在平行行中延伸的多个第一传感器（311a），和

彼此电连接并沿着与所述第一方向交叉的第二方向在平行列中延伸的多个第二传感器（312a）；以及

在所述多个第一传感器（311a）和所述多个第二传感器（312a）的至少一部分上的绝缘层（340）。

2、根据权利要求1所述的有机发光显示装置，其中所述多个第一传感器和所述多个第二传感器在所述封装基板的面向所述基板（100）的所述侧之上。

3、根据权利要求1所述的有机发光显示装置，其中所述多个第一传感器和所述多个第二传感器被交替地布置。

4、根据权利要求1所述的有机发光显示装置，其中所述多个第一传感器在平行于所述基板的平面中的投影偏离于所述多个第二传感器在该平面中的投影。

5、根据权利要求1所述的有机发光显示装置，进一步包括被电连接至所述多个第一传感器和所述多个第二传感器的柔性印刷电路板。

6、根据权利要求5所述的有机发光显示装置，进一步包括在所述基板上的所述显示单元的外围的数据线，该数据线用于将所述触摸单元产生的电信号传送给所述柔性印刷电路板；并且

其中所述数据线被电连接至所述多个第一传感器和所述多个第二传感器。

7、根据权利要求6所述的有机发光显示装置，进一步包括在所述数据线与

所述多个第一传感器的至少一个之间、与所述多个第二传感器的至少一个之间的导电体，该导电体用于在所述数据线与所述多个第一传感器的所述至少一个之间、与所述多个第二传感器的所述至少一个之间提供导电通路。

8、根据权利要求6所述的有机发光显示装置，进一步包括：

在包括所述多个第一传感器和所述多个第二传感器的区域的外围的接触单元；以及

在所述数据线与所述接触单元之间的导电体，以电连接所述数据线与所述接触单元。

9、根据权利要求5所述的有机发光显示装置，其中所述柔性印刷电路板包括用于驱动和控制所述显示单元以及用于驱动和控制所述触摸单元的电路。

10、根据权利要求5所述的有机发光显示装置，进一步包括显示驱动集成电路，该显示驱动集成电路包括触摸单元驱动集成电路。

11、根据权利要求1所述的有机发光显示装置，其中所述显示单元(200)包括：

在所述基板(100)上的薄膜晶体管(220)；以及

被连接至所述薄膜晶体管(220)的有机发光二极管(230)，该有机发光二极管(230)包括反电极(235)、像素电极(231)和在所述反电极(235)与所述像素电极(231)之间的中间层(233)。

12、根据权利要求11所述的有机发光显示装置，其中所述像素电极(231)接触所述薄膜晶体管(220)，所述中间层(233)接触所述像素电极(231)的至少一部分，并且所述反电极(235)接触所述中间层(233)的至少一部分。

13、根据权利要求1所述的有机发光显示装置，其中所述多个第一传感器和所述多个第二传感器包括氧化铟锡。

14、根据权利要求1所述的有机发光显示装置，其中所述触摸单元在所述基板(100)与所述封装基板(300)之间的空间内。

15、根据权利要求1所述的有机发光显示装置，其中所述多个第一传感器和所述多个第二传感器被配置以产生表示触控的电信号。

16、根据权利要求1所述的有机发光显示装置，其中
所述多个第一传感器（311a）中的每个传感器包括第一菱形焊盘；并且
所述多个第二传感器（312a）中的每个传感器包括处于与所述第一菱形焊盘中的一个菱形焊盘相邻的位置的第二菱形焊盘。

17、根据权利要求1所述的有机发光显示装置，其中所述第一方向垂直于所述第二方向。

18、根据权利要求1所述的有机发光显示装置，其中所述触摸单元是静电电容型触摸单元。

19、根据权利要求1所述的有机发光显示装置，进一步包括：
在所述封装基板的所述侧上的第一图案层，该第一图案层包括：
所述多个第一传感器，和
所述多个第二传感器；以及

在所述绝缘层的至少一部分上的第二图案层，该第二图案层包括多个图案单元（325），每个图案单元被配置以连接所述第一图案层（310）上的所述多个第二传感器（312a）中的两个传感器。

20、根据权利要求19所述的有机发光显示装置，进一步包括在所述第二图案层的至少一部分上的第二绝缘层（330）。

21、根据权利要求20所述的有机发光显示装置，其中所述第二绝缘层（330）包括多个接触孔，通过所述接触孔，所述图案单元（325）被电连接至所述多个第二传感器（312a）。

22、根据权利要求21所述的有机发光显示装置，其中
所述多个第一传感器（311a）中的每个传感器包括第一菱形焊盘；
所述多个第二传感器（312a）中的每个传感器包括处于与所述第一菱形焊盘中的一个菱形焊盘相邻的位置的第二菱形焊盘；并且
所述多个接触孔被布置在与所述多个第二传感器（312a）的第二菱形焊盘的拐角对应的位置，其中相邻的第二传感器被彼此连接。

23、根据权利要求21所述的有机发光显示装置，其中所述图案单元（325）

被配置成填充所述多个接触孔，以电连接所述第一图案层（310）上的彼此相邻的所述多个第二传感器。

24、根据权利要求 19 所述的有机发光显示装置，其中
所述显示单元（200）包括：

在所述基板（100）上的薄膜晶体管（220）；和

被连接至所述薄膜晶体管（220）的有机发光二极管（230），该有机发光二极管（230）包括反电极（235）、像素电极（231）和在所述反电极（235）与所述像素电极（231）之间的中间层（233）；并且

其中所述反电极（235）和所述第一图案层（310）被配置以形成第一电容器。

25、根据权利要求 24 所述的有机发光显示装置，其中

所述第一图案层（310）被进一步配置为与接近所述封装基板（300）的物体形成第二电容器；并且

其中所述第一电容器与所述第二电容器串联地电连接。

26、根据权利要求 19 所述的有机发光显示装置，进一步包括被连接至所述多个第一传感器（311a）和所述多个第二传感器（312a）的柔性印刷电路板（130），并且

其中所述柔性印刷电路板（130）包括用于驱动和控制所述触摸单元的电路。

27、根据权利要求 26 所述的有机发光显示装置，进一步包括：

在所述基板（100）上的所述显示单元（200）的外围的数据线（110），该数据线用于将所述触摸单元产生的电信号传送给所述柔性印刷电路板（130）；
以及

在所述基板（100）与所述封装基板（300）之间并用于在所述封装基板（300）上的触摸单元与所述数据线（110）之间提供导电通路的导电体（120）。

28、根据权利要求 27 所述的有机发光显示装置，其中

所述柔性印刷电路板（130）进一步包括第一印刷电路板连接单元（115）
和第二印刷电路板连接单元（113）；并且

其中所述第一印刷电路板连接单元(115)连接所述显示单元(200)至所述柔性印刷电路板(130),所述第二印刷电路板连接单元(113)连接所述数据线(110)至所述柔性印刷电路板(130)。

29、根据权利要求1所述的有机发光显示装置,进一步包括:

在所述封装基板的所述侧上的第一图案层(410),该第一图案层包括所述多个第一传感器(411a);

在所述第一图案层(410)的至少一部分上的绝缘层(430);

在所述绝缘层(430)的至少一部分上的第二图案层(420),该第二图案层(420)包括所述多个第二传感器(421a);以及

在所述第二图案层(420)的至少一部分上的第二绝缘层(440)。

30、根据权利要求29所述的有机发光显示装置,其中

所述多个第一传感器(411a)中的每个传感器包括第一菱形焊盘;并且

所述多个第二传感器(421a)中的每个传感器包括处于与所述第一菱形焊盘中的一个菱形焊盘相邻的位置的第二菱形焊盘。

31、根据权利要求29所述的有机发光显示装置,其中

多个第一连接单元(411b)被配置,以电连接所述第一图案层(410)上的彼此相邻的所述多个第一传感器(411a);并且

多个第二连接单元(421b)被配置,以电连接所述第二图案层(420)上的彼此相邻的所述多个第二传感器(421a)。

32、根据权利要求29所述的有机发光显示装置,其中

所述显示单元(200)包括:

在所述基板(100)上的薄膜晶体管(220);和

被连接至所述薄膜晶体管(220)的有机发光二极管(230),该有机发光二极管(230)包括反电极(235)、像素电极(231)和在所述反电极(235)与所述像素电极(231)之间的中间层(233);并且

其中所述反电极(235)和所述第一图案层(410)被配置以形成第一电容器。

33、根据权利要求 32 所述的有机发光显示装置，其中

所述第一图案层（410）被进一步配置为与接近所述封装基板（400）的物体形成第二电容器；并且

其中所述第一电容器与所述第二电容器串联地电连接。

34、根据权利要求 29 所述的有机发光显示装置，进一步包括被连接至所述多个第一传感器（411a）和所述多个第二传感器（421a）的柔性印刷电路板（130）；并且

其中所述柔性印刷电路板（130）包括用于驱动和控制所述触摸单元的电路。

35、根据权利要求 34 所述的有机发光显示装置，进一步包括：

在所述基板（100）上的所述显示单元（200）的外围的数据线（110），该数据线用于将所述触摸单元产生的电信号传送给所述柔性印刷电路板（130）；以及

在所述基板（100）与所述封装基板（400）之间并用于在所述封装基板（400）上的触摸单元与所述数据线（110）之间提供导电通路的导电体（120）。

36、根据权利要求 35 所述的有机发光显示装置，其中

所述柔性印刷电路板（130）进一步包括第一印刷电路板连接单元（115）和第二印刷电路板连接单元（113），

其中所述第一印刷电路板连接单元（115）连接所述显示单元（200）至所述柔性印刷电路板（130），所述第二印刷电路板连接单元（113）连接所述数据线（110）至所述柔性印刷电路板（130）。

有机发光显示装置

相关申请的交叉引用

本申请要求于 2008 年 7 月 11 日提交的美国临时专利申请 No. 61/080,179 以及于 2009 年 1 月 7 日提交的美国专利申请 No. 12/350,101 的优先权和权益，以上申请的全部内容通过引用合并于此。

技术领域

本发明涉及有机发光显示装置，更具体地说，涉及具有静电电容型触摸面板的有机发光显示装置。

背景技术

近来，便携式薄平板显示装置的使用显著地增加。平板显示装置的代表性实例是电致发光显示装置，因为具有宽视角、高对比度和快响应速度，所以该电致发光显示装置作为有源矩阵型显示装置，被期望成为下一代显示装置。而且，与无机发光显示装置相比，具有由有机材料形成的发射层的有机发光显示装置具有更好的亮度、驱动电压和响应速度，并且能够实现多色。

为了允许用户通过手指或笔型指示器输入命令，许多研究已被进行，以获得具有触摸面板功能的有机发光显示装置，例如内部静电电容型触摸面板显示装置。

不过，在具有内部静电电容型触摸面板的有机发光显示装置的情况下，为了嵌入触摸面板功能，触摸面板的厚度被增加。另外，显示驱动集成电路（DDI）和触摸面板驱动集成电路必须被独立布置，从而导致产品之间的兼容问题。而且，连接触摸面板驱动集成电路至柔性印刷电路板（PCB）是困难的。

发明内容

本发明实施例的角度关注有机发光显示装置。在一个实施例中，该显示装置包括一封装基板，该封装基板的内表面利用氧化铟锡（ITO）图案被图案化，以便触摸面板功能能够被提供而不增加所述显示装置的厚度。

按照一实施例，一种有机发光显示装置包括：基板；在所述基板上的显示单元；具有面向所述基板的侧的封装基板；面向所述显示单元的触摸单元，该触摸单元包括彼此电连接并沿着第一方向在平行行中延伸的多个第一传感器，和彼此电连接并沿着与所述第一方向交叉的第二方向在平行列中延伸的多个第二传感器；以及在所述多个第一传感器和所述多个第二传感器的至少一部分上的绝缘层。

按照另外的实施例，所述多个第一传感器和所述多个第二传感器在所述封装基板的面向所述基板的所述侧之上。

按照另一实施例，所述多个第一传感器和所述多个第二传感器被交替地布置。

按照又一实施例，所述多个第一传感器在平行于所述基板的平面中的投影偏离于所述多个第二传感器在该平面中的投影。

按照再一实施例，所述有机发光显示装置进一步包括被电连接至所述多个第一传感器和所述多个第二传感器的柔性印刷电路板。

在另一实施例中，所述有机发光显示装置进一步包括在所述基板上的所述显示单元的外围的数据线，该数据线用于将所述触摸单元产生的电信号传送给所述柔性印刷电路板；并且，其中所述数据线被电连接至所述多个第一传感器和所述多个第二传感器。

在又一实施例中，所述有机发光显示装置进一步包括在所述数据线与所述多个第一传感器的至少一个之间、与所述多个第二传感器的至少一个之间的导电体，该导电体用于在所述数据线与所述多个第一传感器的所述至少一个之间、与所述多个第二传感器的所述至少一个之间提供导电通路。

在一实施例中，所述有机发光显示装置进一步包括在包括所述多个第一传感器和所述多个第二传感器的区域的外围的接触单元；以及在所述数据线与所述接触单元之间的导电体，以电连接所述数据线与所述接触单元。

在进一步实施例中，所述柔性印刷电路板包括用于驱动和控制所述显示单元以及用于驱动和控制所述触摸单元的电路。

在另一实施例中，所述有机发光显示装置进一步包括显示驱动集成电路，该显示驱动集成电路包括触摸单元驱动集成电路。

按照下一实施例，所述显示单元包括：在所述基板上的薄膜晶体管；以及被连接至所述薄膜晶体管的有机发光二极管，该有机发光二极管包括反电极、像素电极和在所述反电极与所述像素电极之间的中间层。

在又一实施例中，所述像素电极接触所述薄膜晶体管，其中所述中间层接触所述像素电极的至少一部分，并且所述反电极接触所述中间层的至少一部分。

按照一实施例，所述多个第一传感器和所述多个第二传感器包括氧化铟锡。

按照另一实施例，所述触摸单元在所述基板与所述封装基板之间的空间内。

按照又一实施例中，所述多个第一传感器和所述多个第二传感器被配置以产生表示触控的电信号。

按照一实施例，所述多个第一传感器中的每个传感器包括第一菱形焊盘，并且所述多个第二传感器中的每个传感器包括处于与所述第一菱形焊盘中的一个菱形焊盘相邻的位置的第二菱形焊盘。

按照另一实施例，所述第一方向垂直于所述第二方向。

按照又一实施例，所述触摸单元是静电电容型触摸单元。

按照一实施例，所述有机发光显示装置进一步包括：在所述封装基板的所述侧上的第一图案层，该第一图案层包括所述多个第一传感器和所述多个第二传感器；以及在所述绝缘层的至少一部分上的第二图案层，该第二图案层包括多个图案单元，每个图案单元被配置以连接所述第一图案层上的所述多个第二传感器中的两个传感器。

在又一实施例中，所述有机发光显示装置进一步包括在所述第二图案层的

至少一部分上的第二绝缘层。

在一实施例中，所述第二绝缘层包括多个接触孔，通过所述接触孔，所述图案单元被电连接至所述多个第二传感器。

在另一实施例中，所述多个第一传感器中的每个传感器包括第一菱形焊盘，其中所述多个第二传感器中的每个传感器包括处于与所述第一菱形焊盘中的一个菱形焊盘相邻的位置的第二菱形焊盘，并且所述多个接触孔被布置在与所述多个第二传感器的第二菱形焊盘的拐角对应的位置，其中相邻的第二传感器彼此连接。

在又一实施例中，所述图案单元被配置成填充所述多个接触孔，以电连接所述第一图案层上的彼此相邻的所述多个第二传感器。

在一实施例中，所述显示单元包括：在所述基板上的薄膜晶体管；以及被连接至所述薄膜晶体管的有机发光二极管，该有机发光二极管包括反电极、像素电极和在所述反电极与所述像素电极之间的中间层；并且其中所述反电极和所述第一图案层被配置以形成第一电容器。

在另一实施例中，所述第一图案层被进一步配置为与接近所述封装基板的物体形成第二电容器，并且所述第一电容器与所述第二电容器串联地电连接。

在又一实施例中，所述有机发光显示装置进一步包括被连接至所述多个第一传感器和所述多个第二传感器的柔性印刷电路板，并且其中所述柔性印刷电路板包括用于驱动和控制所述触摸单元的电路。

在又一实施例中，所述有机发光显示装置进一步包括在所述基板上的所述显示单元的外围的数据线，该数据线用于将所述触摸单元产生的电信号传送给所述柔性印刷电路板；以及在所述基板与所述封装基板之间并用于在所述封装基板上的触摸单元与所述数据线之间提供导电通路的导电体。

在一实施例中，所述柔性印刷电路板进一步包括第一印刷电路板连接单元和第二印刷电路板连接单元，并且其中所述第一印刷电路板连接单元连接所述显示单元至所述柔性印刷电路板，所述第二印刷电路板连接单元连接所述数据线至所述柔性印刷电路板。

按照另一实施例，所述有机发光显示装置进一步包括：在所述封装基板的所述侧上的第一图案层，该第一图案层包括所述多个第一传感器；在所述第一图案层的至少一部分上的绝缘层；在所述绝缘层的至少一部分上的第二图案层，该第二图案层包括所述多个第二传感器；以及在所述第二图案层的至少一部分上的第二绝缘层。

在又一实施例中，所述多个第一传感器中的每个传感器包括第一菱形焊盘，并且所述多个第二传感器中的每个传感器包括处于与所述第一菱形焊盘中的一个菱形焊盘相邻的位置的第二菱形焊盘。

在又一实施例中，多个第一连接单元被配置，以电连接所述第一图案层上的彼此相邻的所述多个第一传感器；并且多个第二连接单元被配置，以电连接所述第二图案层上的彼此相邻的所述多个第二传感器。

在一些实施例中，所述显示单元包括在所述基板上的薄膜晶体管，以及被连接至所述薄膜晶体管的有机发光二极管，该有机发光二极管包括反电极、像素电极和在所述反电极与所述像素电极之间的中间层，其中所述反电极和所述第一图案层被配置以形成第一电容器。

在一实施例中，所述第一图案层被进一步配置为与接近所述封装基板的物体形成第二电容器，其中所述第一电容器与所述第二电容器串联地电连接。

在另一实施例中，所述有机发光显示装置进一步包括被连接至所述多个第一传感器和所述多个第二传感器的柔性印刷电路板，其中所述柔性印刷电路板包括用于驱动和控制所述触摸单元的电路。

在另一实施例中，所述有机发光显示装置进一步包括：在所述基板上的所述显示单元的外围的数据线，该数据线用于将所述触摸单元产生的电信号传送给所述柔性印刷电路板；以及在所述基板与所述封装基板之间并用于在所述封装基板上的触摸单元与所述数据线之间提供导电通路的导电体。

在一实施例中，所述柔性印刷电路板进一步包括第一印刷电路板连接单元和第二印刷电路板连接单元，并且其中所述第一印刷电路板连接单元连接所述显示单元至所述柔性印刷电路板，所述第二印刷电路板连接单元连接所述数据

线至所述柔性印刷电路板。

附图说明

附图和说明书一起示出本发明的示例性实施例，并且附图和说明一起用于阐述本发明的原理。

图 1 为根据本发明一实施例的有机发光显示装置的一部分的剖面示意图；

图 2 为图 1 的有机发光显示装置的平面示意图；

图 3A 和图 3B 为图 1 的有机发光显示装置中的封装基板和形成在该封装基板的表面上的第一图案层的底部示意图；

图 3C 为图 3A 和图 3B 的第一图案层和在该第一图案层上的第二图案层的底部示意图；

图 3D 为沿着图 3C 中的线 III-III 截取的剖面图；

图 3E 为图 3C 的第一图案层和第二图案层的底部透视示意图；

图 4 为图 1 的有机发光显示装置的详细的平面示意图；

图 5 为图 4 的有机发光显示装置的剖面图；

图 6 为图 1 的有机发光显示装置的一部分的剖面示意图；

图 7A 为根据本发明一实施例的有机发光显示装置中的封装基板和形成在该封装基板的表面上的第一图案层的底部示意图；

图 7B 为图 7A 的第一图案层和在该第一图案层上的第二图案层的底部示意图；

图 7C 为沿着图 7B 中的线 VII-VII 截取的剖面示意图；以及

图 7D 为图 7B 的第一图案层和第二图案层的底部透视示意图。

具体实施方式

在下列的详细描述中，本发明的某些示例性实施例只作为实例被示出和描述。本领域技术人员应当认识到，本发明可以许多不同的形式实施，而不

应该被解释为局限于此处提出的实施例。而且，在本申请的上下文中，当提到一元件在另一元件“上”时，该元件可以直接在另一元件上或通过插置于它们之间的一或多个中间元件间接在另一元件上。整个说明书中，同样的附图标记表示同样的元件。

图 1 为根据本发明一实施例的有机发光显示装置的一部分的剖面示意图，图 2 为图 1 的有机发光显示装置的平面示意图。在图 2 中，图 1 所示的封装基板 300 未被示出。

参见图 1 和图 2，包括多个有机发光二极管（OLED）的显示单元 200 被形成在基板 100 上。

基板 100 可由包含 SiO₂ 作为主要成分的透明玻璃形成，但不限于此，因此也可由透明塑性材料形成，该透明塑性材料可以是选自由聚醚砜（PES）、聚丙烯酸酯（PAR）、聚醚酰亚胺（PEI）、聚苯二甲酸乙二醇酯（PEN）、聚对苯二甲酸乙二酯（PET）、聚苯硫醚（PPS）、聚烯丙基（polyallylate）、聚酰亚胺、聚碳酸酯（PC）、三醋酸纤维素（TAC）、醋酸丙酸纤维素（CAP）及其组合构成的组中的绝缘有机材料。

在一实施例中，如果图 1 和图 2 的有机发光显示装置是底部发射型有机发光显示装置，其中图像朝向基板 100 被实现，那么基板 100 由透明材料形成。不过，在另一实施例中，如果图 1 和图 2 的有机发光显示装置是顶部发射型有机发光显示装置，其中图像远离基板 100 被实现，那么基板 100 可不必由透明材料形成，而且在这种情况下，基板 100 可由金属形成。当基板 100 由金属形成时，基板 100 可包括选自由碳、铁、铬、锰、镍、钛、钼、不锈钢（SUS）、因瓦合金、镍铬铁耐蚀合金及可伐合金组成的组中的至少一种材料，但不限于此。另外，基板 100 也可由金属箔形成。

另外，缓冲层可以进一步被形成在基板 100 的顶部表面上，以平坦化基板 100 并防止或减少杂质渗透到底部发射型有机发光显示装置中。

包括形成在其上的显示单元 200 的基板 100，被连接至布置在显示单元 200 上方的封装基板 300 上。封装基板 300 不仅可由玻璃材料形成，而且可

由诸如丙烯酸酯 (acryl) 之类的各种合适的塑性材料形成, 另外可由金属形成。随后将参照后面的图 3A 至图 3E, 更详细地描述封装基板 300 和形成于封装基板 300 的表面的触摸面板相关部件。

此外, 基板 100 和封装基板 300 通过使用密封剂 250 彼此连接。密封剂 250 可以是任何合适的密封玻璃料。而且, 密封剂 250 可由有机密封剂、无机密封剂或有机和无机密封剂的混合物形成。

下文中, 将更详细地描述在根据本发明实施例的有机发光显示装置中的封装基板 300 和形成在封装基板 300 的表面的触摸面板相关部件。

图 3A 和图 3B 为图 1 的有机发光显示装置中的封装基板 300 和形成在封装基板 300 的表面的第一图案层的底部示意图。图 3C 为图 3A 和图 3B 的第一图案层和在该第一图案层上的第二图案层的底部示意图。图 3D 为沿图 3C 中的线 III-III 截取的剖面图。图 3E 为图 3C 的第一图案层和第二图案层的底部透视示意图。

参见图 3A 至图 3E, 第一图案层 310、第一绝缘层 330、第二图案层 320 及第二绝缘层 340 (见图 5) 被分别顺次形成在封装基板 300 的表面上, 以面向基板 100。

常规的具有内部静电电容型触摸面板的有机发光显示装置的问题在于, 为了实现触摸面板功能而使显示装置的厚度增加。为了解决该问题, 氧化铟锡 (ITO) 图案被形成在根据本发明一实施例的有机发光显示装置的封装基板 300 的内表面上。

更详细地说, 第一图案层 310 被形成在封装基板 300 的表面上以面向基板 100 (见图 1)。第一图案层 310 包括沿着第一方向 (图 3A 中的 X 方向) 在平行行中形成的多个第一方向图案单元 311, 以及沿着与第一方向交叉 (或基本上垂直) 的第二方向 (图 3B 中的 Y 方向) 在平行列中形成的多个第二方向图案单元 312。如图 3A 和图 3B 所示, 第一方向图案单元 311 和第二方向图案单元 312 被交替布置。也就是说, 每个都具有像棒球样菱形 (baseball diamond) 那样被旋转 45° 的正方形体的第一方向图案单元 311, 被形成在

平行行中，其中每个菱形的水平相对的拐角是相邻的且沿着第一方向（图 3A 中的 X 方向）在封装基板 300 的表面上被连接。类似地，每个都具有像棒球样菱形那样被旋转 45° 的正方形体的第二方向图案单元 312，被形成在平行列中，其中每个菱形的垂直相对的拐角是相邻的且沿着第二方向（图 3B 中的 Y 方向）在各个第一方向图案单元 311 之间被连接。这里，在许多实施例中，图案单元(311 和 312)被用作传感器(或传感器焊盘(sensor pad))。

参考字符 A 是指图 3A 中第一方向图案单元 311 的一行，其中第一方向图案单元 311 的每行包括多个主体 311a、多个连接单元 311b、延伸单元 311c 和接触单元 311d。主体 311a 具有菱形形状，并且沿着第一方向，即图 3A 中的 X 方向被形成在行中。连接单元 311b 被形成在各个主体 311a 之间，并分别连接彼此相邻的主体 311a。延伸单元 311c 从第一方向图案单元 311 的每个的端部延伸。延伸单元 311c 可以被形成以沿着一方向，例如图 3A 中的 Y 方向延伸，以便多个延伸单元 311c 可以被布置在封装基板 300 的一端(或一端部分)，即图 3A 中的封装基板 300 的上端。接触单元 311d 被形成在延伸单元 311c 的一端(或上端部分)，并通过导电元件 120（见图 5）被电连接至基板 100（见图 5）上的数据线 110 的基板接触单元 112（见图 5）。

在图 3B 中，参考字符 B 是指第二方向图案单元 312 的一列。第二方向图案单元 312 的每列包括多个主体 312a、延伸单元 312c 和接触单元 312d。主体 312a 具有菱形形状，并沿着第二方向，即图 3B 中的 Y 方向被形成在列中。与第一方向图案单元 311 不同，第二方向图案单元 312 中任何一个均不包括连接单元。主体 312a 不通过连接单元而通过第二图案层 320 被彼此连接，而是第二图案层 320 具有例如用于将主体 312a 彼此相连的多个第三图案单元 325（见图 3E）。延伸单元 312c 从接触单元 312d 延伸至紧密接近菱形主体 312a 的拐角的点，其中此菱形主体 312a 最接近封装基板 300 的上端。延伸单元 312c 可以被形成，以沿着一方向例如图 3B 中的 Y 方向延伸，以便多个延伸单元 312c 可以被布置在封装基板 300 的一端，即图 3B 中的封装基板 300 的上端。接触单元 312d 被形成在延伸单元 312c 的端部，并通过

导电元件 120 (见图 5) 被电连接至基板 100 (见图 5) 上的数据线 110 的基板接触单元 (见图 5)。

参见图 3D 和图 3E, 第一绝缘层 330 被形成在封装基板 300 的表面上, 以便面向基板 100 (见图 1) 并覆盖第一图案层 310。第一绝缘层 330 将第一图案层 310 与第二图案层 320 绝缘。多个接触孔 (或通孔) 331 可以被形成在第一绝缘层 330 中的预定位置, 例如与第二方向图案单元 312 的菱形主体 312a 的相邻拐角相应的位置。第二图案层 320 和第二方向图案单元 312 的主体 312a 通过接触孔 331 被电连接。

如图 3C 至图 3E 所示, 第二图案层 320 被形成在第一绝缘层 330 的表面上以面向基板 100 (见图 1)。第二图案层 320 即导电层被形成, 以便填充第一绝缘层 330 的接触孔 331, 从而电连接 (例如, 通过通孔和第三图案单元 325) 第二方向图案单元 312 的彼此相邻的主体 312a。

以这种方式, 被交替布置的第一方向图案单元 311 和第二方向图案单元 312 彼此不相交 (或电连接), 以便第一方向图案单元 311 与第二方向图案单元 312 之间的短路被阻止。

第一图案层 310 和第二图案层 320 可由诸如 ITO、IZO、ZnO 和/或 In_2O_3 之类的合适的透明材料形成。而且, 第一图案层 310 和第二图案层 320 可通过使用光刻工艺形成。也就是说, 通过使用合适的沉积方法、旋转涂覆方法、溅射方法或喷墨方法形成的 ITO 层, 可以被用于形成第一图案层 310 和第二图案层 320。

现在参见图 5, 第二绝缘层 340 既被形成在第一绝缘层 330 的表面上以面向基板 100, 又被形成在第二图案层 320 的表面上。第二绝缘层 340 的相对侧邻接显示单元 200。第二绝缘层 340 将第二图案层 320 与显示单元 200 绝缘。

以这种方式, 根据本发明一实施例, 有可能实现触摸面板功能而不增加显示装置的厚度。而且, 因为静电电容图案被形成在封装基板 300 的内表面上, 所以细 (或薄) 蚀刻是可能的。

下文中,将更详细地描述封装基板的图案层与基板的印刷电路板(PCB)之间的连接关系。

图4为图1的有机发光显示装置的详细的平面示意图,图5为图4的有机发光显示装置的剖面图。

参见图4和图5,被形成在封装基板300上的第一方向图案单元311的接触单元311d和第二方向图案单元312的接触单元312d,被电连接至形成在基板100上的数据线110。为了形成此连接,根据本发明一实施例的有机发光显示装置包括导电元件120。

更详细地说,用于显示图像的显示单元200被形成在基板100上(稍后将参照图6更详细地描述显示单元200)。柔性PCB130与显示单元200一起被布置,其中用于驱动和控制显示单元200的各种合适的电组件被设置在柔性PCB130上。显示驱动集成电路(DDI)111被布置在显示单元200与柔性PCB130之间,以驱动显示单元200。DDI111和柔性PCB130可通过多根输入/输出线115被连接。

数据线110被形成在显示单元200的周围,并且被形成在基板100上。数据线110被用于传送电信号给柔性PCB130,该电信号由形成在封装基板300的内表面上的第一、第二图案层(310和320)产生。为了传送这些电信号,数据线110进一步包括位于基板上的多个基板接触单元112(见图5)。

基板接触单元112被形成在与第一方向图案单元311的接触单元311d的位置对应的,且与第二方向图案单元312的接触单元312d的位置对应的位置处的基板上。基板接触单元112被形成在基板100上,接触单元311d和312d被形成在封装基板300上,并都通过导电元件120被电连接。包括银浆的各种导电材料可以被用于导电元件120。基板接触单元112被逐一连接至与柔性PCB130相连的数据线110。

被配置成接收电信号以驱动和控制触摸面板的触摸面板驱动集成电路(TDI)113,被布置在柔性PCB130上,其中电信号由形成在封装基板300的内表面上的第一图案层310和第二图案层320产生。

以这种方式,根据本发明一实施例的有机发光显示装置包括用于显示装置中的常规柔性 PCB,以提供用于实现触摸面板功能的集成接口。这样做,可能有效地降低制造成本及提高制造商的轻便性和用户的便利。

而且,参见图 4,DDI 111 和 TDI 113 被示出为独立地布置,但本发明不限于此。也就是说,尽管未在图中示出,但 DDI 111 可以在一些实施例中被实施为包括 TDI 113 的功能。在这种情况下,数据线 110 可以被配置以与 DDI 111 直接相连。这样做,可能有效地进一步降低制造成本及提高制造商和用户的便利性。

下文中,将详细描述根据本发明一实施例的有机发光显示装置中的显示单元的结构。

图 6 为图 1 的有机发光显示装置的一部分的剖面图,示出显示单元 200 的详细配置。

参见图 6,多个薄膜晶体管 220 被形成在基板 100 上,且有机发光二极管(OLED) 230 被形成在每个薄膜晶体管 220 上(或一起形成)。OLED 230 包括被电连接至薄膜晶体管 220 的像素电极 231、整个布置在基板 100 上的反电极 235,以及布置在像素电极 231 与反电极 235 之间的包括发光层的中间层 233。

每个都包括栅极 221、源极、漏极 223 及半导体层 227 的薄膜晶体管 220、栅极绝缘层 213 及层间绝缘层 215 被形成在基板 100 上。本实施例不限于图 6 的薄膜晶体管 220。因此,诸如包括由有机材料形成的半导体层的有机薄膜晶体管或由硅形成的硅薄膜晶体管之类的其它薄膜晶体管,也可以被使用。在一些实施例中,由硅氧化物或硅氮化物形成的缓冲层 211 可以进一步被包括在薄膜晶体管 220 与基板 100 之间。

OLED 230 包括彼此有效面对的像素电极 231 和反电极 235。OLED 进一步包括由有机材料形成的且被布置在像素电极 231 与反电极 235 之间的中间层 233。包括发光层的中间层 233 也可以包括多个层。

像素电极 231 作为阳极工作,而反电极 235 作为阴极工作。不过,像素

电极 231 和反电极 235 的极性可以被转换。

像素电极 231 可以被作为透明电极或反射电极形成。当被作为透明电极形成时，像素电极 231 可以由 ITO、IZO、ZnO 和/或 In₂O₃ 形成。当被作为反射电极形成时，像素电极 231 可以包括由 Ag、Mg、Al、Pt、Pd、Au、Ni、Nd、Ir、Cr 或其组合物形成的反射层以及形成在该反射层上的包括 ITO、IZO、ZnO 和/或 In₂O₃ 的层。

反电极 235 也可以被作为透明电极或反射电极形成。当被作为透明电极形成时，反电极 235 可以包括其中的 Li、Ca、LiF/Ca、LiF/Al、Al、Mg 或其组合物被沉积在像素电极 231 与反电极 235 之间的中间层 233 上的层。在一些实施例中，反电极层也可以包括总电极线和由 ITO、IZO、ZnO 和/或 In₂O₃ 形成的辅助电极。当被作为反射电极形成时，反电极 235 可以通过沉积 Li、Ca、LiF/Ca、LiF/Al、Al、Mg 或其组合物被形成。

像素限定层 (PDL) 219 被形成，以覆盖像素电极 231 的边缘（或边缘部分）并具有从像素电极 231 测量到反电极 235 的厚度（或预定的厚度）。PDL 219 限定发光区域，并在像素电极 231 的边缘与反电极 235 之间提供宽间隙，以防止电场聚集在像素电极 231 的边缘，从而防止（或保护免于）像素电极 231 与反电极 235 之间的潜在的短路。

每个均包括至少一发光层的多个中间层 233 可以被形成在各个相应的像素电极 231 与各个相应的反电极 235 之间。在图 6 中，中间层 233 可由低分子有机材料或聚合物有机材料形成。

当由低分子有机材料形成时，中间层 233 可以具有单层或多层结构，其中空穴注入层 (HIL)、空穴传输层 (HTL)、有机发光层 (EML)、电子传输层 (ETL) 和电子注入层 (EIL) 被堆叠。有机材料的示例包括铜酞菁 (CuPc)、N,N'-二(萘-1-基)-N,N'-二苯基-联苯胺 (NPB)、三-8-羟基喹啉铝 (Alq₃) 等。低分子有机材料可以使用真空沉积方法和掩模被形成。

当由聚合物有机材料形成时，中间层 233 可以具有由 HTL 和 EML 形成的结构，HTL 可以由聚(3,4-乙撑二氧噻吩) (PEDOT) 形成，EML 可以由

聚对苯乙炔 (PPV) 和聚芴形成。

OLED 230 被电连接至布置在下面的薄膜晶体管 220。当覆盖薄膜晶体管 220 的平坦化层 (planarization layer) 217 被形成时, OLED 230 被布置在平坦化层 217 的顶部, 且像素电极 231 通过形成在平坦化层 217 中的接触孔被电连接至薄膜晶体管 220。

在图 6 所示的实施例中, 形成在基板 100 上的 OLED 230 通过封装基板 300 被密封。封装基板 300 可由诸如如上所述的玻璃或塑料之类的各种合适的材料形成。而且, 如上所述, 图案层 (指图 5 中的第一图案层 310 和第二图案层 320) 和绝缘层 (指图 5 中的第一绝缘层 330 和第二绝缘层 340) 被顺次形成在封装基板 300 的内表面上, 从而使其可能提供触摸面板功能。

现将简要描述驱动根据本发明一实施例的有机发光显示装置的方法。

返回参见图 4 和图 5, 当手指、导电物体或高介电物体接近或触控根据本发明一实施例的有机发光显示装置的表面时, 该有机发光显示装置解释由此接近引起的导体的静电电荷 (电容) 的变化, 从而感应触控。基于该触控, 包括该触控在表面上的坐标及压力值的输出被产生。

更详细地说, 作为恒定电压, 阴极电压在显示单元 200 的接触第二绝缘层 340 的反电极 235 中流动 (见图 6)。因此, 第一图案层 310 和反电极 235 形成一个电容器, 而且第一图案层 310 与反电极 235 之间的静电电荷被保持恒定。如果手指、导电物体或高介电物体接近或触控封装基板 300 上的表面, 那么手指和第一图案层 310 形成第二电容器。这两个电容器被有效地串联连接, 而且整个静电电荷随着触控变化。通过利用静电电荷变化发生的位置和变化大小, 触控感应系统能够感应触控及其大小, 并定位该触控的位置。

图 7A 为根据本发明另一实施例的有机发光显示装置中的封装基板 400 和形成在封装基板 400 的表面的第一图案层 410 的底部示意图。图 7B 为图 7A 的第一图案层 410 和在该第一图案层顶部的第二图案层 420 的底部示意图。图 7C 为沿图 7B 中的线 VII-VII 截取的剖面图。图 7D 为图 7B 的第一图案层 410 和第二图案层 420 的底部透视示意图。

参见图 7A 至图 7D, 第一图案层 410、第一绝缘层 430、第二图案层 420 及第二绝缘层 440 被分别顺次形成在封装基板 400 的表面上, 以面向基板。

在图 7A 至图 7D 所示的实施例中, 第一方向图案单元和第二方向图案单元并不使用单一的图案层形成。而是, 第一方向图案单元 411 使用第一图案层 410 形成, 而第二方向图案单元 421 使用第二图案层 420 形成。

更详细地说, 第一图案层 410 被形成在封装基板 400 的表面上以面向基板 100 (见图 1)。第一图案层 410 包括沿第一方向 (图 7A 中的 X 方向) 形成在平行行中的多个第一方向图案单元 411。图 7A 中所示的参考字符 A 是指第一方向图案单元 411 的一行。如图 7A 所示, 第一方向图案单元 411 被形成在平行行中。这里, 在许多实施例中, 图案单元 (411 和 421) 被用作传感器 (或传感器焊盘)。

图 7A 中的参考字符 A 是指第一方向图案单元 411 的一行, 其中第一方向图案单元 411 的每行包括多个主体 411a、多个连接单元 411b、延伸单元 411c 和接触单元 411d。主体 411a 具有菱形形状, 并且沿着第一方向, 即图 7A 中的 X 方向被形成在平行行中。连接单元 411b 被形成在各个主体 411a 之间, 从而连接彼此相邻的主体 411a。延伸单元 411c 从第一方向图案单元 411 的每个的端部延伸。延伸单元 411c 可以被形成以沿着一方向, 例如图 7A 中的 Y 方向延伸, 以便多个延伸单元 411c 可以被布置在封装基板 400 的一端, 即图 7A 中的封装基板 400 的上端。接触单元 411d 被形成在延伸单元 411c 的端部, 并通过导电元件被电连接至基板上的数据线的基板接触单元。

参见图 7C 和图 7D, 第一绝缘层 430 被形成在封装基板 400 的表面上, 以面向基板并覆盖第一图案层 410。第一绝缘层 430 将第一图案层 410 与第二图案层 420 绝缘。

如图 7B 至图 7D 所示, 第二图案层 420 被形成在第一绝缘层 430 的顶部以面向基板 100 (见图 1)。

更详细地说, 第二图案层 420 包括沿着第二方向 (图 7B 中的 Y 方向)

形成在平行列中的第二方向图案单元 421。图 7B 所示的参考字符 B 表示第二方向图案单元 421 的一列。如图 7B 所示，第二方向图案单元 421 被形成在平行列中。在图 7B 中，虚线或隐藏线表示图 7A 所示的第一图案层 410。

在图 7B 中，参考字符 B 是指第二方向图案单元 421 的一列。第二方向图案单元 421 的每列包括多个主体 421a、延伸单元 421c 及接触单元 421d。主体 421a 具有菱形形状，并沿着第二方向，即图 7B 中的 Y 方向被形成在列中。连接单元 421b 被形成在各个主体 421a 之间，从而连接彼此相邻的主体 421a。延伸单元 421c 从第二方向图案单元 421 的每个的端部延伸。延伸单元 421c 可以被形成，以沿着一方向例如图 7B 中的 Y 方向延伸，以便多个延伸单元 421c 可以被布置在封装基板 400 的一端，即图 7B 中的封装基板 400 的上端。接触单元 421d 被形成在延伸单元 421c 的端部，并且通过导电元件被电连接至所述基板上的数据线的基板接触单元。

第一图案层 410 和第二图案层 420 可以由诸如 ITO、IZO、ZnO 或 In₂O₃ 之类的透明材料形成。而且，第一图案层 410 和第二图案层 420 可以通过使用光刻工艺形成。也就是说，通过使用沉积方法、旋转涂覆方法、溅射方法和/或喷墨方法形成的 ITO 层，可以被用于形成第一图案层 410 和第二图案层 420。

现在参见图 7C，第二绝缘层 440 既被形成在第一绝缘层 430 上以面向基板，又被形成在第二图案层 420 上。第二绝缘层 440 的相对侧为面向（例如邻接）显示单元。第二绝缘层 440 将第二图案层 420 与显示单元 200 绝缘（见图 5）。

以这种方式，根据本发明的实施例，有可能提供具有触摸面板功能的显示面板而不增加显示面板的厚度。而且，因为静电电容图案被形成在封装基板的内表面上，所以细（或薄）蚀刻是可能的。

尽管本发明已结合特定示例性实施例被描述，但是应理解，本发明不限于所公开的实施例，相反，本发明意在涵盖包括在所附权利要求书和其等同物的精神和范围内的各种改进和等同布置。

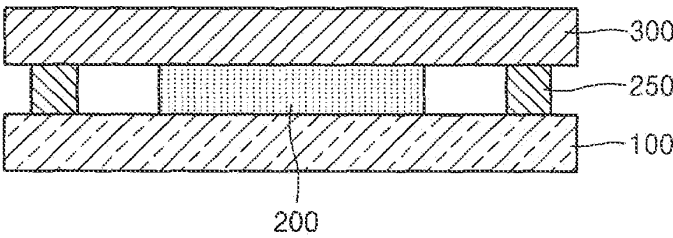


图 1

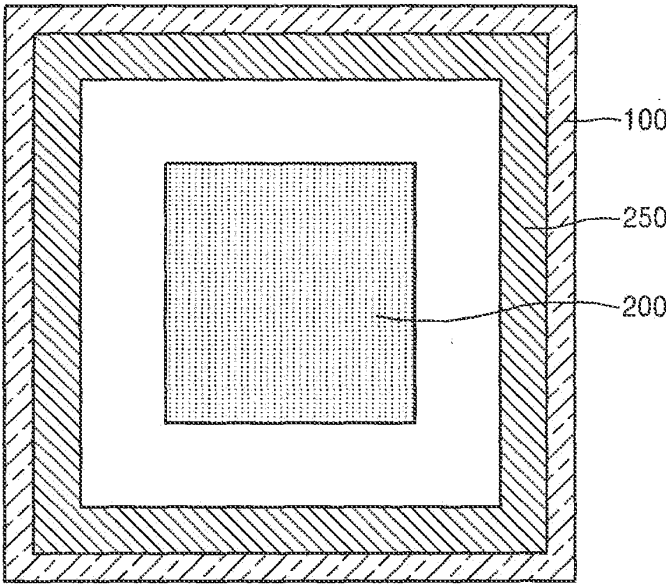


图 2

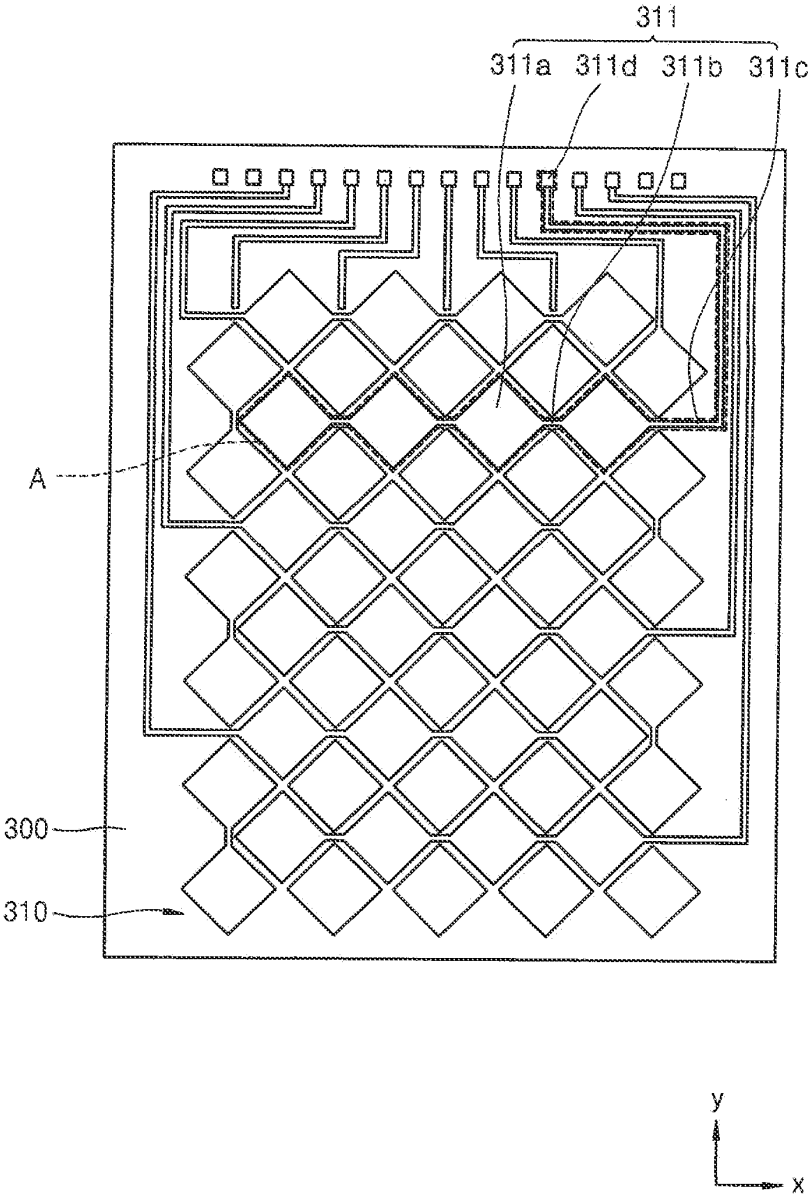


图 3A

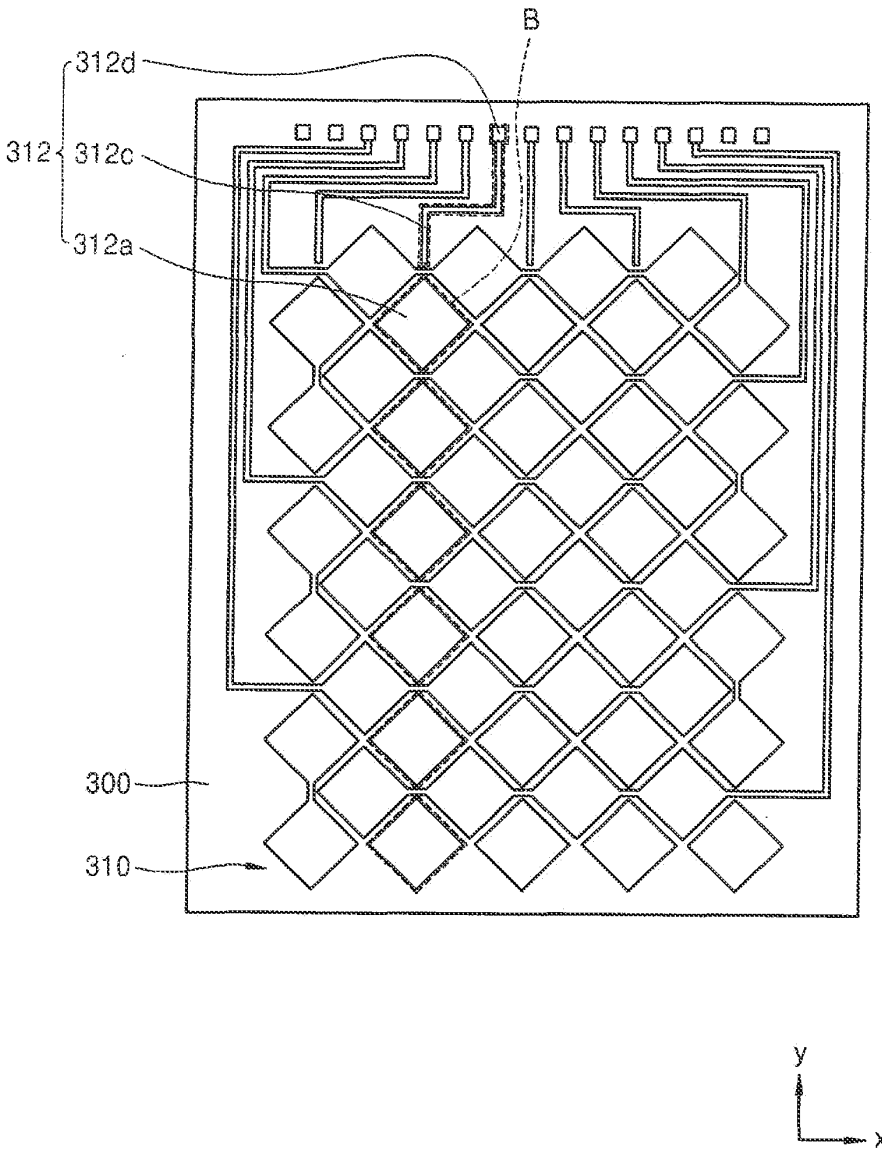


图 3B

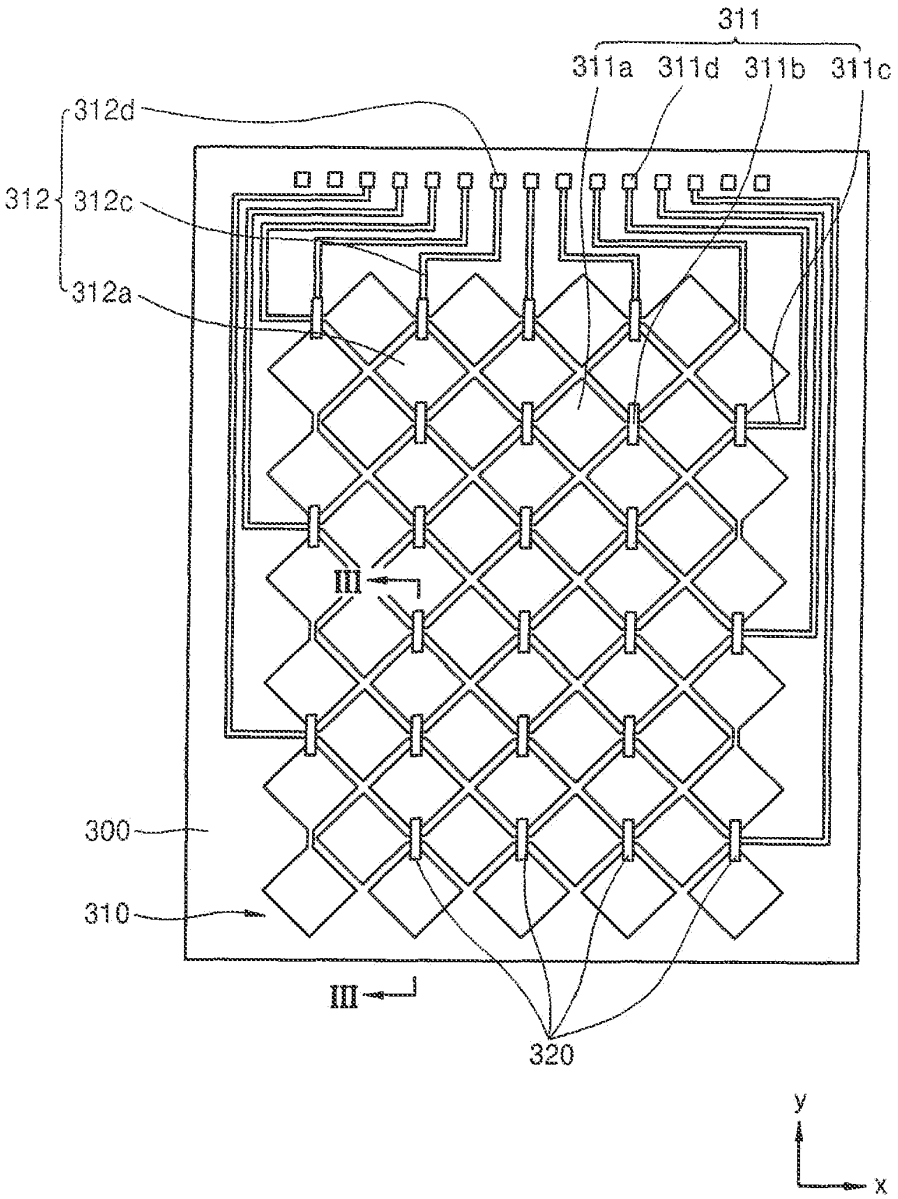


图 3C

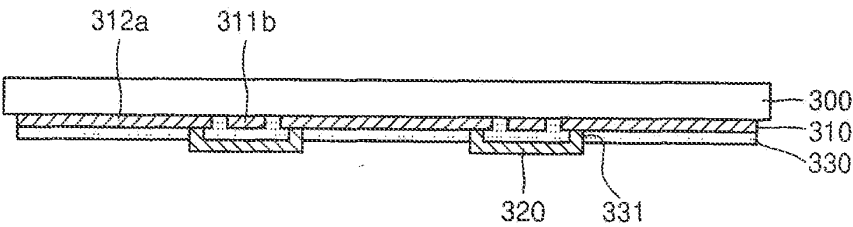


图 3D

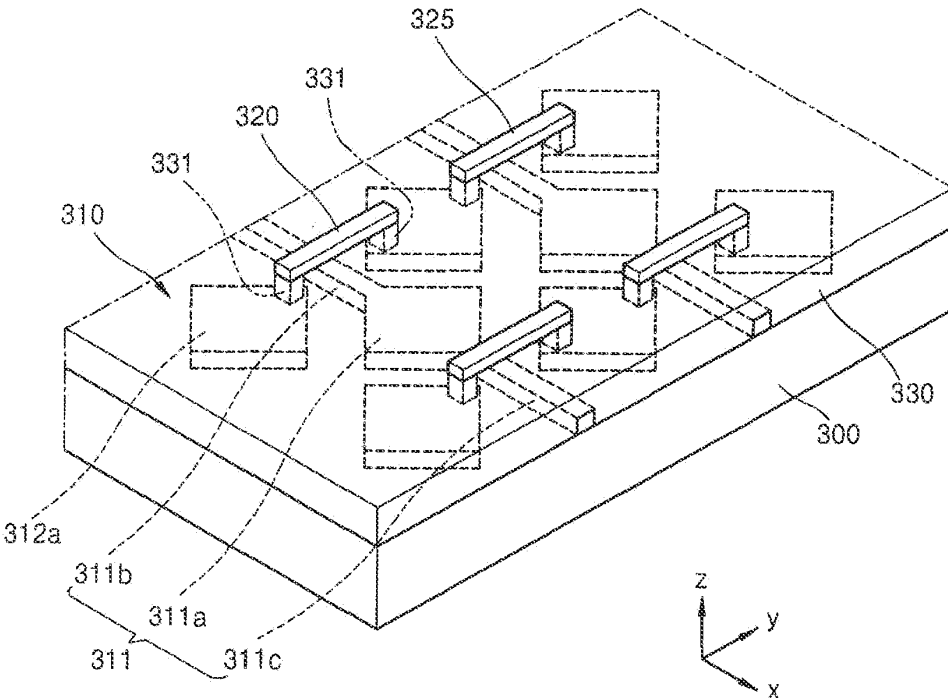
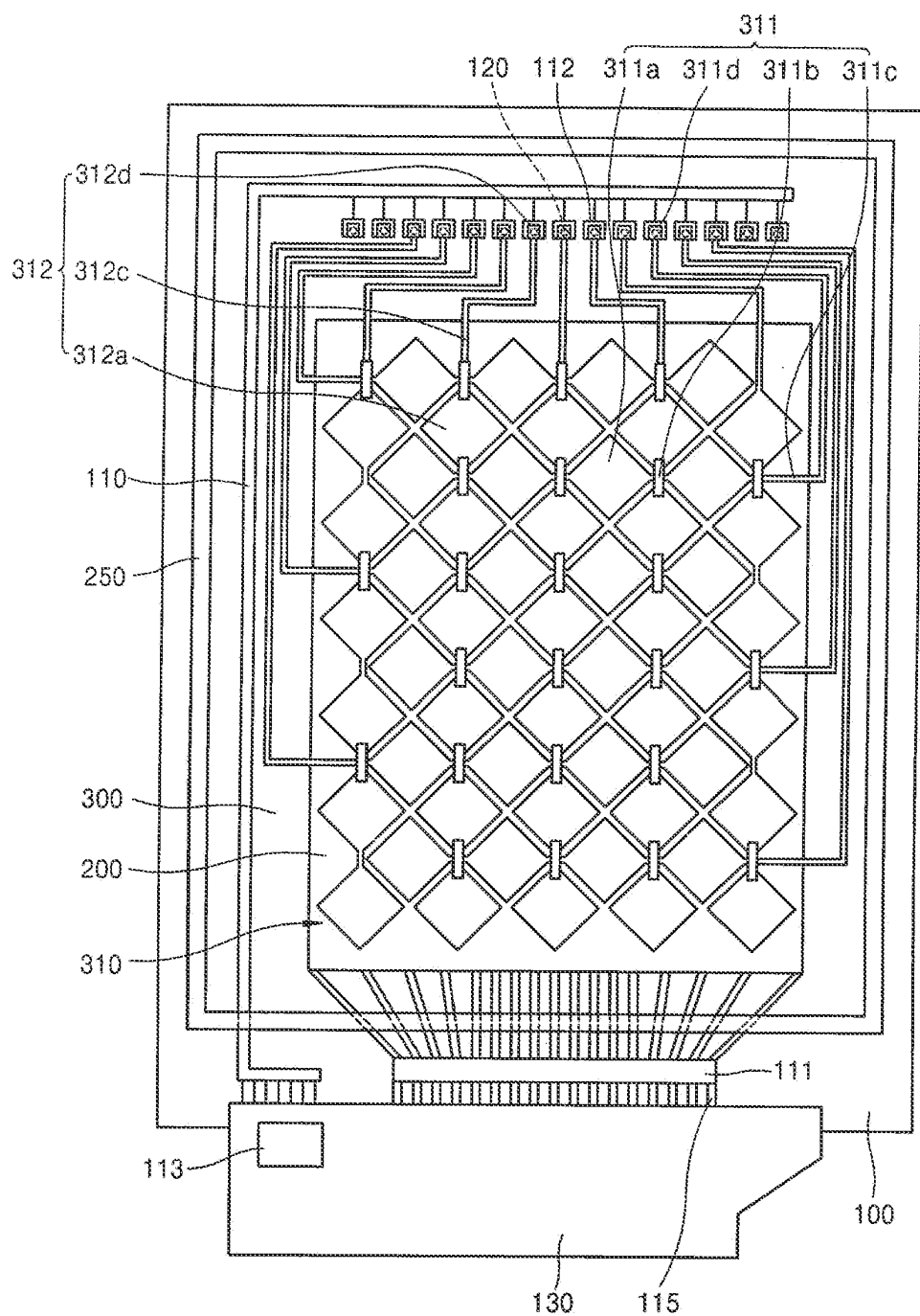


图 3E

 4

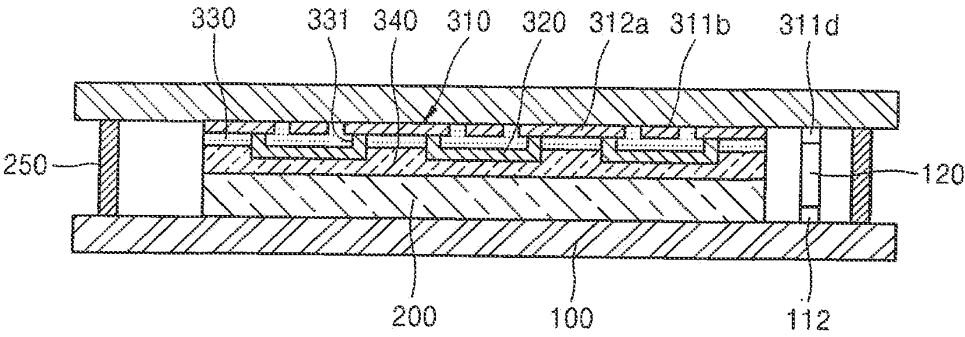


图 5

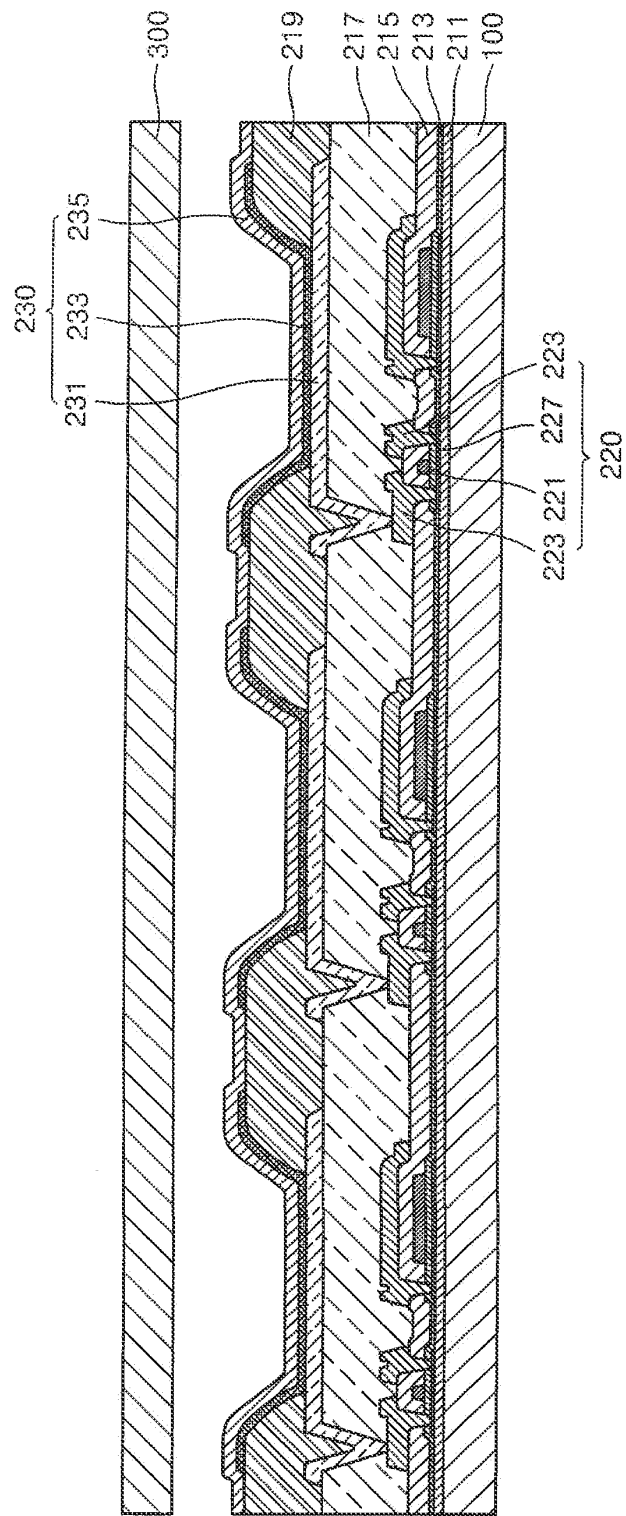


图 6

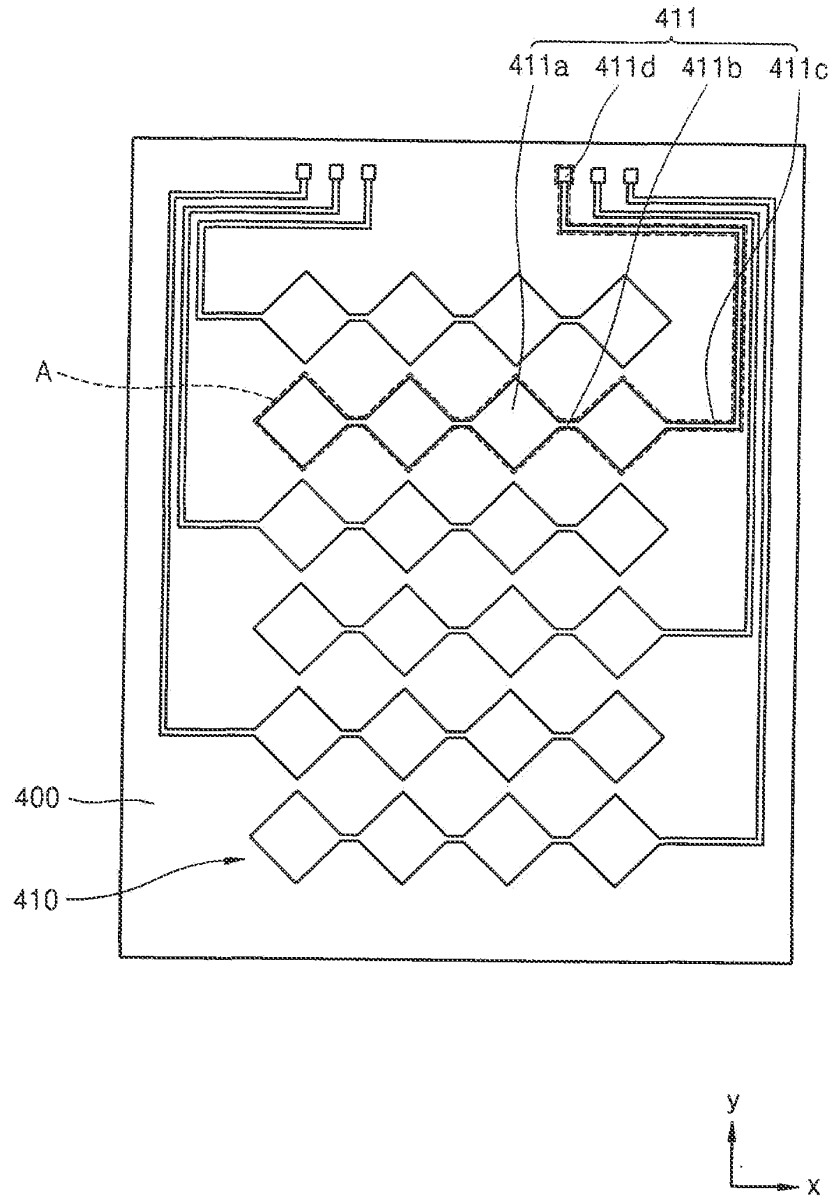


图 7A

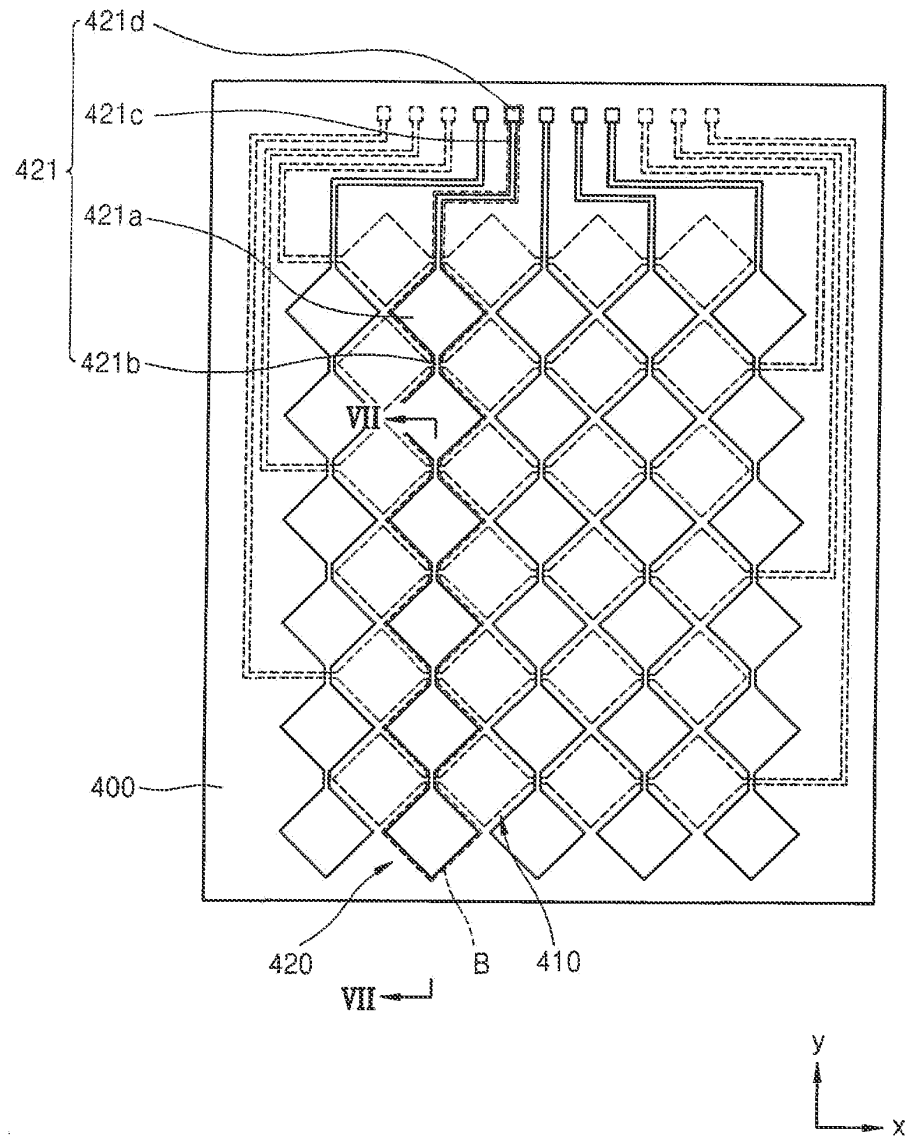


图 7B

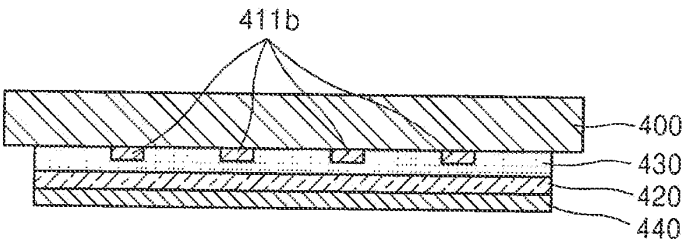


图 7C

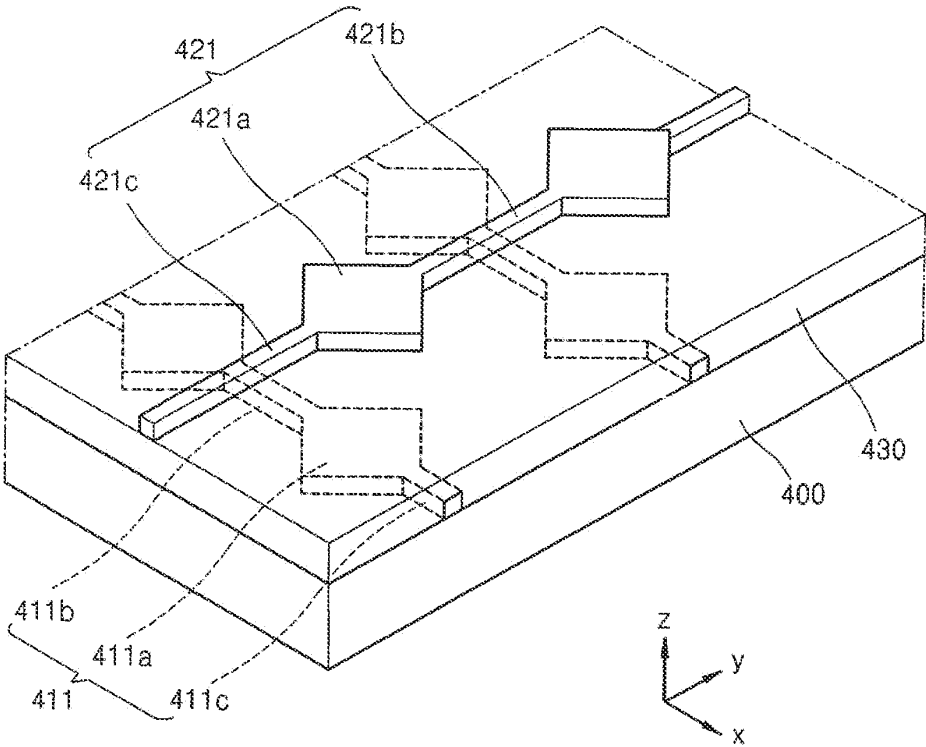


图 7D

[19] 中华人民共和国国家知识产权局



[12] 发明专利申请公布说明书

[21] 申请号 200980000383. X

[51] Int. Cl.

G06F 3/041 (2006.01)

G02F 1/133 (2006.01)

G02F 1/1343 (2006.01)

[43] 公开日 2010 年 3 月 24 日

[11] 公开号 CN 101681221A

[22] 申请日 2009.3.25

[21] 申请号 200980000383. X

[30] 优先权

[32] 2008. 3. 28 [33] JP [31] 087739/2008

[86] 国际申请 PCT/JP2009/055949 2009.3.25

[87] 国际公布 WO2009/119664 日 2009.10.1

[85] 进入国家阶段日期 2009.11.27

[71] 申请人 索尼株式会社

地址 日本东京

[72] 发明人 野口幸治 高间大辅 木田芳利

[74] 专利代理机构 北京信慧永光知识产权代理有限公司

代理人 褚海英 武玉琴

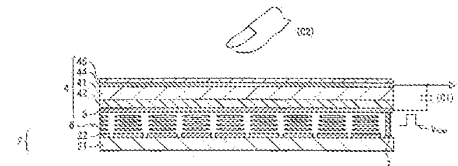
权利要求书 4 页 说明书 17 页 附图 17 页

[54] 发明名称

具有触摸传感器的显示装置

[57] 摘要

最初设于液晶显示元件中的显示用公共电极 43 也用作触摸传感器的一对电极中的一个(驱动电极), 并且重新形成所述一对电极中的另一个(传感器用检测电极 44)。作为显示驱动信号的现有的公共驱动信号 V_{com} 兼用于触摸传感器的驱动信号。在所述公共电极 43 和所述传感器用检测电极 44 之间形成电容, 并且通过利用由用户的手指接触所带来的电容值的变化实现触摸检测。于是, 具有触摸传感器的显示装置也可以用于在许多情况下用户的电位不恒定的移动装置。新设置的电极只有传感器用检测电极 44, 不必重新准备用于触摸传感器的驱动信号。因而, 结构简单。



1. 一种具有触摸传感器的显示装置，其包括：
多个显示像素电极；
与所述显示像素电极相对的公共电极；
具有图像显示功能的显示功能层；
显示控制电路，其根据图像信号通过在每个所述显示像素电极和所述公共电极之间施加显示用电压来进行图像显示控制，从而发挥所述显示功能层的显示功能；以及
触摸检测电极，其与所述公共电极相对设置，或者设置在所述公共电极旁边，在所述触摸检测电极和所述公共电极之间形成电容。
2. 如权利要求 1 所述的具有触摸传感器的显示装置，还包括触摸检测电路，该触摸检测电路通过利用显示驱动电压作为触摸传感器驱动信号，根据从所述触摸检测电极所得到的检测信号来检测被物体所触摸的位置，所述显示驱动电压通过显示控制部被施加在所述公共电极上。
3. 如权利要求 2 所述的具有触摸传感器的显示装置，其包括：
电路基板，所述显示控制电路形成于该电路基板中；以及
面对所述电路基板的相对基板，其中，
所述显示像素电极设于所述电路基板上的靠近于所述相对基板的一侧，
所述公共电极设于所述相对基板上的靠近于所述电路基板的一侧，并且
所述显示功能层设置为夹持在所述电路基板中的显示像素电极和所述相对基板上的公共电极之间。
4. 如权利要求 3 所述的具有触摸传感器的显示装置，其中，所述触摸检测电极设于所述相对基板上的与所述电路基板相反的一侧。
5. 如权利要求 3 所述的具有触摸传感器的显示装置，其中，所述触摸检测电极被分成多个电极图形。
6. 如权利要求 3 所述的具有触摸传感器的显示装置，其中，所述触摸

检测电路形成于所述电路基板中。

7. 如权利要求 3 所述的具有触摸传感器的显示装置，其中，所述显示功能层是液晶层。

8. 如权利要求 2 所述的具有触摸传感器的显示装置，其包括：
电路基板，所述显示控制电路形成于该电路基板中；以及
面对所述电路基板的相对基板，其中，

所述公共电极和所述显示像素电极在所述电路基板上依次堆叠，其中绝缘层介于所述公共电极和所述显示像素电极之间，并且

所述显示功能层设置为夹持在所述电路基板上的所述显示像素电极和所述相对基板之间。

9. 如权利要求 8 所述的具有触摸传感器的显示装置，其中，所述触摸检测电极设于所述电路基板上。

10. 如权利要求 9 所述的具有触摸传感器的显示装置，其中，
所述公共电极设于所述电路基板的显示区域的内部，并且
在围绕所述电路基板的显示区域的框架区域中，所述触摸检测电极与
所述公共电极分开地形成成为与所述公共电极处于相同层中的电极层。

11. 如权利要求 9 所述的具有触摸传感器的显示装置，其中，
所述公共电极在所述电路基板上从显示区域延伸到框架区域，并且
在所述电路基板上的所述框架区域中，所述触摸检测电极形成成为与
所述公共电极处于不同层中的电极层，从而面对所述公共电极。

12. 如权利要求 9 所述的具有触摸传感器的显示装置，还包括对所述触摸检测电极进行电磁屏蔽的屏蔽电极。

13. 如权利要求 8 所述的具有触摸传感器的显示装置，其中，所述触摸检测电极设于所述相对基板上。

14. 如权利要求 13 所述的具有触摸传感器的显示装置，其中，所述触摸检测电极设于所述相对基板上的靠近于所述电路基板的一侧。

15. 如权利要求 13 所述的具有触摸传感器的显示装置，其中，所述触摸检测电极设于所述相对基板上与所述电路基板相反的一侧。

16. 如权利要求 15 所述的具有触摸传感器的显示装置，其中，所述触摸检测电极通过利用薄膜处理直接形成于所述相对基板上。

17. 如权利要求 15 所述的具有触摸传感器的显示装置，其中，所述触摸检测电极形成于基膜上，并且其上具有所述触摸检测电极的所述基膜粘附在所述相对基板上。

18. 如权利要求 13 所述的具有触摸传感器的显示装置，其中，所述触摸检测电路形成于所述电路基板中。

19. 如权利要求 18 所述的具有触摸传感器的显示装置，其中，在所述相对基板上的触摸检测电极和所述电路基板中的触摸检测电路之间形成导电路径以进行连接。

20. 如权利要求 18 所述的具有触摸传感器的显示装置，其中，在所述相对基板上的触摸检测电极和所述电路基板的触摸检测电路之间形成电容耦合路径以建立电容耦合。

21. 如权利要求 20 所述的具有触摸传感器的显示装置，其中，所述相对基板上的触摸检测电极通过具有高阻值的电阻器接地。

22. 如权利要求 8 所述的具有触摸传感器的显示装置，其中，所述触摸检测电极被分成多个电极图形。

23. 如权利要求 8 所述的具有触摸传感器的显示装置，其中，所述显示功能层由液晶层构成，并且在横向电场模式下实现液晶显示。

具有触摸传感器的显示装置

技术领域

本发明涉及诸如液晶显示装置的显示装置，具体地涉及具有触摸传感器的显示装置，该显示装置包括能够通过用户的手指等触摸而输入信息的电容型触摸传感器。

背景技术

近年来，能够通过设置接触检测装置(以下，称为触摸传感器)、即设置所谓的触摸板而输入信息的显示装置已受到关注，所述触摸板直接安装在液晶显示装置上并且在液晶显示装置上显示各种按钮而代替普通按钮。随着移动装置的屏幕尺寸倾向于大型化，该技术使得显示屏和各按钮可以共同设置，并且带来了诸如节省空间和减少部件个数的极大好处。但是，在该技术中存在的问题是，由于安装了触摸板，所以整个液晶模块的厚度增大。具体说来，在应用于移动装置时，由于在触摸板上需要保护层以防止刮擦，所以存在液晶模块的厚度变得越来越厚的问题，而这有悖于薄化的趋势。

于是，例如，在专利文献1中，提出了一种具有触摸板的液晶显示元件，其中触摸板的导电膜设于液晶显示元件的观看侧的基板以及布置于观看侧的基板的外表面上的用于观看的偏光板之间，并且利用偏光板的外表面作为触摸表面，电容型的触摸板形成于触摸板的导电膜和偏光板的外表面之间。由此，实现了薄型化。

专利文献1：日本未审查专利申请文件No.2008-9750

发明内容

但是，在专利文献1所披露的具有触摸板的液晶显示元件中，触摸板的导电膜理论上需要具有与用户相同的电位，并且用户需要是接地属性。于是，尽管应用于从电源插座等获取电源的静止的电视接收机不成问题，但是将具有触摸板的液晶显示元件应用于移动装置在实践上是特别困难

的。而且，在上述技术中，由于触摸板的导电膜需要极其靠近用户的手指，所以触摸板的导电膜的布置区域是有限的，并且难以将触摸板的导电膜例如设置在液晶显示元件内的深入部分。也就是说，设计的灵活性低。而且，在上述技术中，因为配置，必须与液晶显示元件的显示驱动电路部相互独立地设置诸如触摸板驱动部和坐标检测部的电路部，并且难以集成整个装置的各电路。

鉴于前文所述，本发明的第一目的是提供一种具体适用于移动装置的具有触摸传感器的显示装置。本发明的第二目的是提供具有高的设计灵活性的具有触摸传感器的显示装置。本发明的第三目的是提供具有电路易于集成的结构的具有触摸传感器的显示装置。

本发明的具有触摸传感器的显示装置包括：多个显示像素电极；与所述显示像素电极相对的公共电极；具有图像显示功能的显示功能层；显示控制电路，其根据图像信号通过在每个所述显示像素电极和所述公共电极之间施加显示用电压来进行图像显示控制，从而发挥所述显示功能层的显示功能；以及触摸检测电极，其与所述公共电极相对设置，或者设置在所述公共电极旁边，在所述触摸检测电极和所述公共电极之间形成电容。

在本发明的具有触摸传感器的显示装置中，电容形成于最初设置用于施加显示驱动电压的所述公共电极和新设置的所述触摸检测电极之间。该电容根据物体接触的存在或不存在而改变。因而，当由显示控制部施加在公共电极上的显示驱动电压被利用（或使用）为所述触摸传感器的驱动信号时，可以从所述触摸检测电极得到与电容值的变化相应的检测信号。当所述检测信号被输入给所述触摸检测电路时，能够检测到物体接触的存在或不存在。而且，当所述触摸检测电极被分成多个电极图形，并且所述多个电极图形被单独驱动时，能够检测物体的接触位置。例如可以使用液晶层作为所述显示功能层。

在本发明的具有触摸传感器的显示装置中，可以是这样的结构，即设有面对其中形成有所述显示控制电路的电路基板的相对基板，所述显示像素电极设在所述的电路基板上的靠近于所述相对基板的一侧，所述公共电极设于在所述的相对基板上靠近于所述电路基板的一侧，并且所

述显示功能层设置为夹持在所述电路基板的显示像素电极和所述相对基板的公共电极之间。这种结构例如适合于所述显示功能层由TN(扭曲向列)模式、VA(垂直取向)模式等的液晶构成的情况。在此情况下,所述触摸检测电极优选地形成于相对的电极侧,并且所述触摸检测电路优选地形成于所述电路基板中。

并且,在本发明的具有触摸传感器的显示装置中,可以是这样的结构,即设有面对其中形成有所述显示控制电路的电路基板的相对基板,所述公共电极和所述显示像素电极在所述电路基板上依次堆叠,其中绝缘层介于所述公共电极和所述显示像素电极之间,并且所述显示功能层设置为夹持在所述电路基板的显示像素电极和所述相对基板之间。这种结构例如适合于所述显示功能层由诸如FFS(边缘场切换)模式的所谓横向电场模式的液晶构成的情况。在此情况下,所述触摸检测电极可以形成于所述相对基板侧或所述电路基板侧。所述触摸检测电路优选地形成于所述电路基板中。在所述触摸检测电极形成于所述电路基板侧的情况下,所述公共电极设于所述电路基板的显示区域中,并且在围绕所述电路基板的显示区域的框架区域中,所述触摸检测电极与所述公共电极分开地形成成为与所述公共电极处于相同层中的电极层。在所述触摸检测电极形成于所述相对基板侧,并且所述触摸检测电路形成于所述电路基板中的情况下,导电路径形成为连接于所述相对基板的触摸检测电极和所述电路基板的触摸检测电路之间。或者,电容耦合路径形成为在所述相对基板的触摸检测电极和所述电路基板的触摸检测电路之间建立电容耦合。

根据本发明的具有触摸传感器的显示装置,电容形成于最初设置用于施加显示驱动电压的所述公共电极和新设置的所述触摸检测电极之间,通过利用由物体(用户的手指)的接触所带来的电容值的变化实现触摸检测。于是,可以得到这样的具有触摸传感器的显示装置,即该具有触摸传感器的显示装置甚至可以适用于在许多情况下用户的电位不确定的移动装置中。具体地,当最初配备施加于公共电极以用于显示的现有的显示驱动电压用作触摸传感器的驱动信号时,可以从所述触摸检测电极得到与电容值的变化相应的检测信号,并且因而不必准备新的用于传感

器的驱动信号。而且，当所述触摸检测电极被分成多个电极图形时，并且所述多个电极图形被单独驱动时，能够检测接触位置。

并且，根据本发明的具有触摸传感器的显示装置，可以根据所述显示功能层的类型任意地选择所述触摸检测电极形成于所述相对基板侧或者形成于所述像素基板侧。因而，可以得到设计灵活性高的具有触摸传感器的显示装置。

并且，根据本发明的具有触摸传感器的显示装置，也可以根据所述显示功能层的类型在所述电路基板侧形成所述触摸检测电极。于是，在结构设计中，优选地在所述电路基板中形成所述触摸检测电路，并且这易于在一个电路基板上将显示用电路和传感器用电路集成在一起。即，电路集成容易。

附图说明

图1是用于说明本发明的具有触摸传感器的显示装置的工作原理的图，并且是表示手指未触摸状态的图。

图2是用于说明本发明的具有触摸传感器的显示装置的工作原理的图，并且是表示手指触摸状态的图。

图3是用于说明本发明的具有触摸传感器的显示装置的工作原理的图，并且是表示触摸传感器的驱动信号和检测信号的波形的示例的图。

图4是表示本发明第一实施例的具有触摸传感器的显示装置的示意性横剖面结构的横剖面图。

图5是表示图4中所示的具有触摸传感器的显示装置的主要部分(公共电极和传感器用检测电极)的结构示例的立体图。

图6是表示图4中所示的具有触摸传感器的显示装置的检测电路的配置示例的电路图。

图7是表示图4中所示的具有触摸传感器的显示装置的主要部分(公共电极和传感器用检测电极)的结构示例的另一示例的立体图。

图8是表示图4中所示的具有触摸传感器的显示装置的主要部分(公共电极和传感器用检测电极)的结构的一例的立体图。

图9是表示本发明第二实施例的具有触摸传感器的显示装置的示意性横剖面结构的横剖面图。

图10是图9中所示的具有触摸传感器的显示装置的主要部分的放大的立体图。

图11是用于说明图9中所示的具有触摸传感器的显示装置的工作原理的横剖面图。

图12是表示图9中所示的具有触摸传感器的显示装置的结构的具体示例的横剖面图。

图13是表示图9中所示的具有触摸传感器的显示装置的变化例的横剖面图。

图14是表示图9中所示的具有触摸传感器的显示装置的另一变化例的横剖面图。

图15是表示图14中所示的具有触摸传感器的显示装置的结构的具体示例的横剖面图。

图16是表示本发明第三实施例的具有触摸传感器的显示装置的示意性横剖面结构的横剖面图。

图17是表示图16中所示的具有触摸传感器的显示装置的示意性平面结构的平面图。

图18是表示图16中所示的具有触摸传感器的显示装置的变化例的主要部分的横剖面图。

图19是表示图16中所示的具有触摸传感器的显示装置的另一变化例的示意性横剖面图。

具体实施方式

以下，参照附图详细说明实施本发明的最优方式(以下简称为实施例)。

首先,参照图1~图3,说明本实施例的具有触摸传感器的显示装置中的触摸检测方法的基本原理。该触摸检测方法由电容型触摸传感器实现,并且如图1(A)所示,电容性元件是这样构成的,即利用彼此面对的一对电极(驱动电极E1和检测电极E2),并将电介质D介于所述一对电极之间。该配置的等效电路如图1(B)所示。电容性元件C1配置有驱动电极E1、检测电极E2和电介质D。在电容性元件C1中,一端与AC信号源S相连,另一端P通过电阻R接地并且与电压检测器DET相连。当具有预定频率(例如约为几kHz~十几kHz)的AC矩形波 S_g (图3(B))从AC信号源S施加于驱动电极E1(电容性元件C1的一端)时,在检测电极E2(电容性元件C1的另一端P)中会出现如图3(A)所示的输出波形(检测信号 V_{det})。此外,该AC矩形波 S_g 与后文所述的公共驱动信号 V_{com} 对应。

在手指未触摸的状态下,如图1所示,随着电容性元件C1的充电/放电,与电容性元件C1的电容值相应的电流 I_0 流过。这时,电容性元件C1中另一端P的电位的波形例如像图3(A)的波形 V_0 ,并且这通过电压检测器DET检测。

另外,在手指触摸的状态下,如图2所示,由手指所形成的电容性元件C2与电容性元件C1串联相加。在该状态下,随着电容性元件C1和C2的充电/放电,电流 I_1 和 I_2 分别流过。这时,电容性元件C1中另一端P的电位的波形例如像图3(A)的波形 V_1 ,并且这通过电压检测器DET检测。这时,P点的电位是由分别流过电容性元件C1和C2的电流 I_1 和 I_2 的值所限定的电偏势。因而,波形 V_1 变为比未触摸状态下的波形 V_0 的值小。如后文所述,电压检测器DET将所检测的电压与预定的阈值电压 V_{th} 进行比较。当所检测的电压等于或小于阈值电压时,电压检测器DET判定为处于未触摸状态。另外,当所检测的电压等于或大于阈值电压时,电压检测器DET判定为处于触摸状态。这样,可以实现触摸检测。

第一实施例

图4示出了本实施例的具有触摸传感器的显示装置的主要部分的横剖面结构。在该具有触摸传感器的显示装置中,液晶显示元件用作显示元件,并且最初设于该液晶显示元件中的电极(后文所述的公共电极43)

的一部分和用于显示的驱动信号(后文所述的公共驱动信号Vcom)还用于其它目的,由此构成电容型触摸传感器。

如图4所示,该具有触摸传感器的显示装置包括像素基板2、与该像素基板2相对的相对基板4以及夹在像素基板2和相对基板4之间的液晶层6。

该像素基板2包括作为电路基板的TFT基板21和以矩阵形式设于TFT基板21上的多个像素电极22。包括用于驱动每个像素电极22的图中未示出的显示驱动器和TFT(薄膜晶体管)在内,诸如将像素信号供给各像素电极的源极线和驱动各TFT的栅极线的布线也形成于TFT基板21中。而且,在TFT基板21中也形成有后文所述的执行触摸检测操作的检测电路(图6)。

相对基板4包括玻璃基板41、形成于该玻璃基板41的一个表面上的滤色器42和形成于该滤色器42上的公共电极43。该滤色器42是这样构成的,例如将红(R)、绿(G)和蓝(B)三种颜色的滤色器层循环排列,并且每个显示像素(像素电极22)被分配有一组的R、G和B三种颜色。该公共电极43也用作传感器的驱动电极,该驱动电极构成执行触摸检测操作的触摸传感器的一部分,并且与图1中的驱动电极E1相对应。

该公共电极43通过接触导电柱7与TFT基板21耦接。具有AC矩形波形的公共驱动信号Vcom通过该接触导电柱7从TFT基板21施加于公共电极43。该公共驱动信号Vcom限定了施加于像素电极22的像素电压以及各像素的显示电压,并且也用作触摸传感器的驱动信号。公共驱动信号Vcom与从图1的驱动信号源S所供给的AC矩形波Sg相对应。

在玻璃基板41的另一表面上,形成有传感器用检测电极44。而且,在该传感器用检测电极44上,设有偏光板45。传感器用检测电极44构成触摸传感器的一部分,并且与图1中的检测电极E2相对应。

液晶层6根据电场的状态调节穿过液晶层6的光,并且例如由TN(扭曲向列)、VA(垂直取向)和ECB(电控双折射)的各种模式的液晶制成。

取向膜分别设在液晶层6和像素基板2之间以及液晶层6和相对基板4之间。尽管位于光入射侧的偏光板设在像素基板2下方，但图中省略未示出。

图5立体地图示了相对基板4中的公共电极43和传感器用检测电极44的结构示例。在该示例中，公共电极43被分成在图的左右方向上延伸的多个条形电极图形。利用驱动器43D，公共驱动信号Vcom被依次地供给每个电极图形，并且时分地进行线序扫描驱动。另外，传感器用检测电极44配置为在与公共电极43中的电极图形的延伸方向垂直的方向上延伸的多个条形电极图形。检测信号Vdet从传感器用检测电极44中的每个电极图形输出，并且被输入给图6中所示的检测电路8。

图6示出了执行触摸检测操作的检测电路8的结构示例。该检测电路8包括用于信号放大的运算放大器81、截断高频分量并且允许低频分量通过的低通滤波器(LPF)82、允许高频分量通过的高通滤波器(HPF)83、整流平滑部84和比较器85。输入端Tin与运算放大器81的正输入端(+)相连，并且检测信号Vdet被输入给输入端Tin。运算放大器81的输出端通过LPF82与整流平滑部84相连。HPF83与LPF82相连。LPF82具有电阻82R和电容82C并联连接的结构，HPF83具有电阻83R和电容83C在地和LPF82之间串联连接的结构。LPF82和HPF83的连接点与运算放大器81的负输入端(-)相连。整流平滑部84包括由半波整流二极管84D构成的整流部以及平滑部，在该平滑部中，电阻84R和电容82C在地和半波整流二极管84D之间并联连接。整流平滑部84的输出端与比较器85的正输入端(+)相连。预定的阈值电压Vth(参照图3)被输入给比较器85的负输入端(-)。比较器85的输出端与输出端Tout相连，并且检测结果(是否触摸)从输出端Tout输出。

具有该结构的检测电路8按如下方式工作。被输入给输入端Tin的检测信号Vdet被运算放大器81放大。然后，检测信号Vdet中的低频分量通过LPF82，并且高频分量通过HPF83被滤除。通过LPF82的低频AC分量通过整流平滑部84中的二极管84D被半波整流，之后被平滑为水平信号并输入给比较器85。比较器85将输入电平信号与阈值电压Vth进行比较。当输入电平信号等于或小于阈值电压Vth时，比较器85输出触摸检测信号。

检测电路8形成于相对基板4上的周边区域(非显示区域或框架区域)中。或者,检测电路8形成于像素基板2上的周边区域中。但是,当检测电路8形成于像素基板2上时,实现了检测电路8和最初形成于像素基板2上的用于显示控制等的各种电路元件的集成,并且从通过集成实现电路简化的角度看,这是优选的。在此情况下,传感器用检测电极44中的每个电极图形和像素基板2的检测电路8通过类似于接触导电柱7的接触导电柱(图中未示出)相连,并且检测信号Vdet从传感器用检测电极44被传输到检测电路8。

以下说明具有上述配置的具有触摸传感器的显示装置的工作原理。

像素基板2中的显示驱动器(图中未示出)线序地将公共驱动信号Vcom供给公共电极43中的每个电极图形。显示驱动器还通过源极线将像素信号供给像素电极22,并且与像素信号的供给同步地通过栅极线线序地控制各像素电极中TFT的开关。由此,在由公共驱动信号Vcom和各像素信号所限定的纵向(垂直于基板的方向)上的电场施加于各像素的液晶层6,并且调节液晶状态。这样,利用所谓的反转驱动进行显示。

另外,在相对基板4侧,电容性元件C1形成于公共电极43中的各电极图形和传感器用检测电极44中的各电极图形的各交叉部分处。当公共驱动信号Vcom被时分地依次作用于公共电极43中的各电极图形时,在形成于公共电极43中的电极图形和传感器用检测电极44中的各电极图形的各交叉部分处的一列的各电容性元件C1上进行充电/放电,其中公共驱动电压Vcom施加于公共电极43上。因此,具有与电容性元件C1的电容值相应的幅度的检测信号Vdet从传感器用检测电极44中的各电极图形输出。在用户的手指未与相对基板4的表面接触的情况下,该检测信号Vdet的幅度近似于常量。通过公共驱动信号Vcom的扫描,充电/放电的电容性元件C1的列线序地移动。

这里,当用户的手指触摸相对基板4的表面的任意位置时,由手指所形成的电容性元件C2与最初形成于该触摸位置中的电容性元件C1叠加。因此,与其它位置的检测信号Vdet相比,当该触摸位置被扫描时(即,在公共电极43的电极图形中,当公共驱动信号Vcom作用于与该触摸位置对应的电极图形时)的检测信号Vdet的值变小。检测电路8(图6)将该检测信

号Vdet与阈值电压Vth进行比较。当检测信号Vdet等于或小于阈值电压Vth时，检测电路8将该位置判定为触摸位置。该触摸位置可以通过公共驱动信号Vcom的作用时间以及等于或小于阈值电压Vth的检测信号Vdet的检测时间来判定。

这样，根据本实施例，电容型触摸传感器具有这样的结构，即最初设于液晶显示元件中的公共电极43也用作触摸传感器的电极对中的一个，所述电极对包括驱动电极和检测电极，并且作为显示用驱动信号的公共驱动信号Vcom通常兼用作触摸传感器的驱动信号。于是，新设置的电极只有传感器用检测电极44，而且不必重新准备触摸传感器的驱动信号。因而，结构简单。

并且，在相关技术(专利文献1)的具有触摸板的显示装置中，精确测量流过传感器的电流的幅度，并且根据该测量值，利用模拟计算判断触摸位置。另外，在本实施例中，与触摸的存在或不存在相对应的电流的相对变化(电位变化)的存在或不存在可以数字方式检测，并且可以利用简单的检测电路结构提高检测精度。而且，电容形成于最初设置用于施加公共驱动信号Vcom的公共电极43和新设置的传感器用检测电极44之间，并且利用由用户的手指触摸所带来的电容变化进行触摸检测。于是，具有触摸板的显示装置甚至可以应用于用户的电位在许多情况下不恒定的移动装置。

并且，由于传感器用检测电极44被分成多个电极图形，并且多个电极图形被单独地时分驱动，所以能够检测所触摸的位置。

此外，在以上说明中，如图5所示，尽管公共电极43和传感器用检测电极44都形成为通过延伸而彼此交叉的多个电极图形，但并不局限于此。例如，如图7所示，公共电极43形成为整体延伸的单个电极，而传感器用检测电极44形成为以矩阵形式设置的多个单独的电极。在此情况下，可以利用检测信号Vdet从构成传感器用检测电极44的各个单独的电极中立即判断触摸位置。

或者，如图8所示，类似于图5，公共电极43可以形成为按条形分开的多个电极图形，并且类似于图7，传感器用检测电极44形成为以矩阵形

式设置的多个单独的电极。并且在此情况下，可以在利用公共驱动信号Vcom依次扫描公共电极43中的多个电极图形的同时进行检测。

第二实施例

以下，说明第二实施例。本实施例与上述第一实施例的不同之处在于横向电场模式的液晶元件用作显示元件。

图9示出了本实施例的具有触摸传感器的显示装置的主要部分的横剖面结构，并且图10示出了其立体结构。在这些图中，与图4中相同的附图标记表示相同的元件，由此适当地省略说明。

本实施例的具有触摸传感器的显示装置包括像素基板2A、与该像素基板2A相对的相对基板4A以及夹在像素基板2A和相对基板4A之间的液晶层6。

该像素基板2A包括TFT基板21、设于该TFT基板21上的公共电极43以及以矩阵形式设于公共电极43上的多个像素电极22，其中绝缘层23设在公共电极43和多个像素电极22之间。包括用于驱动每个像素电极22的图中未示出的显示驱动器和TFT在内，诸如将像素信号供给各像素电极的源极线和驱动各TFT的栅极线等的布线也形成于TFT基板21中。而且，执行触摸检测操作的检测电路(图6)形成于TFT基板21中。公共电极43也用作传感器的驱动电极，该驱动电极构成执行触摸检测操作的触摸传感器的一部分，并且与图1中的驱动电极E1相对应。

相对基板4A包括玻璃基板41、形成于该玻璃基板41的一个表面上的滤色器42。在玻璃基板41的另一表面上，形成有传感器用检测电极44。而且，在该传感器用检测电极44上，设有偏光板45。传感器用检测电极44构成触摸传感器的一部分，并且与图1中的检测电极E2相对应。如图5、图7或图8所示，传感器用检测电极44被分成多个电极图形。传感器用检测电极44通过利用薄膜处理直接形成于相对基板4A上，或者间接形成于其上。在此情况下，触摸检测电极44形成于图中未示出的膜基板上，并且其上形成有该检测电极44的膜基板粘附于相对基板4A的表面上。在此情况下，不但可以将膜基板粘附在玻璃和偏光板之间，而且可以将其粘附在偏光板的上表面。该膜基板可以形成于构成偏光板的膜中。

具有AC矩形波形的公共驱动信号Vcom从TFT基板21施加于公共电极43。该公共驱动信号Vcom限定了施加于像素电极22的像素电压以及各像素的显示电压，并且也用作触摸传感器的驱动信号。公共驱动信号Vcom与从图1的驱动信号源S所供给的AC矩形波Sg相对应。

液晶层6根据电场的状态调节穿过液晶层6的光，并且例如由FFS(边缘场切换)模式和IPS(平面内切换)模式的横向电场模式的液晶组成。

像素基板2A中的公共电极43和相对基板4A中的传感器用检测电极44的结构例如类似于图5中所示的结构，并且公共电极43和传感器用检测电极44都形成通过延伸而彼此交叉的多个电极图形。但是，公共电极43和传感器用检测电极44的结构也可以类似于上述图7或图8所示的结构。

参照图10，进行更详细的说明。在这里所述的FFS模式的液晶元件中，被图形化为梳状的像素电极22设于形成于像素基板2A上的公共电极43上，绝缘层23设在公共电极43和像素电极22之间，并且形成有覆盖像素电极22的取向膜26。在该取向膜26和位于相对基板4A侧的取向膜46之间，夹持有液晶层6。两个偏光板24和45以正交尼科尔(cross-nichols)的状态设置。两个取向膜26和46的摩擦方向和两个偏光板24和25之一的透射轴一致。在图10中，示出了摩擦方向与光出射侧的偏光板45的透射轴一致的情形。而且，两个取向膜26和46的摩擦方向和偏光板45的透射轴的方向在液晶分子的转动方向所限定的范围内被设置为大致平行于像素电极22的延伸方向(梳的纵向)。

以下，说明上述结构的具有触摸传感器的显示装置的工作原理。

这里，首先参照图10和图11，简要说明FFS模式的液晶元件的显示原理。这里，图11示出了液晶元件的主要部分的放大的横剖面图。在这些图中，(A)示出了没有施加电场时的液晶元件的状态，(B)示出了施加电场时的液晶元件的状态。

在公共电极43和像素电极22之间不施加电压的情况下(图10(A)和图11(A))，构成液晶层6的液晶分子61的轴线垂直于光入射侧的偏光板24的透射轴，并且变得平行于光出射侧的偏光板45的透射轴。因此，透过光

入射侧的偏光板24的入射光h到达光出射侧的偏光板45，而在液晶层6中不产生相差，并且在偏光板45中被吸收，由此显示黑色。另外，在公共电极43和像素电极22之间施加电压的情况下(图10(B)和图11(B))，在像素电极之间所产生的横向电场E的作用下，液晶分子61的对准方向被转为相对于像素电极22的延伸方向倾斜的方向。这时，显示白色时的电场强度被最优化，从而位于液晶层6的厚度方向的中间处的液晶分子61转动大约45度。由此，在入射光h透过光入射侧的偏光板24之后，当透过液晶层6时会在液晶层6中产生相差。于是，入射光h成为转动90度的直线偏振光，并且透过光出射侧的偏光板45，从而显示白色。

以下，说明具有触摸传感器的显示装置的显示控制操作和触摸检测操作。这些操作类似于上述第一实施例中的操作，由此适当地省略说明。

像素基板2A中的显示驱动器(图中未示出)将公共驱动信号Vcom线序地供给公共电极43中的各电极图形。显示驱动器还通过源极线将像素信号供给像素电极22，并且与像素信号的供给同步地通过栅极线以线序的方式控制各像素电极中TFT的开关。由此，在由公共驱动信号Vcom和各像素信号所限定的横向(平行于基板的方向)上的电场施加于用于各像素的液晶层6，并且调节液晶状态。这样，利用所谓的反转驱动进行显示。

另外，在相对基板4A侧，当公共驱动信号Vcom时分地依次作用于公共电极43中的各电极图形时，在形成于公共电极43中的电极图形和传感器用检测电极44中的各电极图形的交叉部分处的一列的各电容性元件C1上进行充电/放电，其中公共驱动电压Vcom施加于公共电极43上。具有与电容性元件C1的电容值相应的幅度的检测信号Vdet从传感器用检测电极44中的各电极图形输出。在用户的手指未与相对基板4A的表面接触的情况下，该检测信号Vdet的幅度接近于常量。当用户的手指接触相对基板4A的表面的任意位置时，由手指所形成的电容性元件C2与最初形成于该触摸位置中的电容性元件C1叠加。因此，与其它位置的检测信号Vdet相比，当该触摸位置被扫描时的检测信号Vdet的值变小。检测电路8(图6)将该检测信号Vdet与阈值电压Vth进行比较。当检测信号Vdet等于或小于阈值电压Vth时，检测电路8将该位置判定为触摸位置。该触摸位置可以

通过公共驱动信号Vcom的作用时间以及等于或小于阈值电压Vth的检测信号Vdet的检测时间来判定。

这样，根据本实施例，类似于上述第一实施例的情况(图5)，电容型触摸传感器具有这样的结构，即最初设于液晶显示元件中的公共电极43也用作触摸传感器的电极对中的一个，所述电极对包括驱动电极和检测电极，并且作为显示用驱动信号的公共驱动信号Vcom通常兼用于触摸传感器的驱动信号。于是，新设置的电极只有传感器用检测电极44，不必重新准备触摸传感器的驱动信号。因而，结构简单。

具体地，在本实施例中，由于作为触摸传感器的驱动电极的公共电极43布置在像素基板2侧(TFT基板21上)，所以及其容易将公共驱动信号Vcom从TFT基板21供给公共电极43，并且必要的电路、电极图形和布线等可以集中在像素基板2中。因而，实现了电路的集成。于是，从像素基板2侧到相对基板4侧的公共驱动信号Vcom的供给路径(接触导电柱7)是不需要的，而所述供给路径在上述第一实施例中是必要的(图5)，这样结构更简单。

此外，尽管检测电路8(图6)形成于相对基板4上的周边区域(非显示区域或框架区域)中，但检测电路8优选地形成于像素基板2上的周边区域中。当检测电路8形成于像素基板2上时，实现了检测电路8和最初形成于像素基板2上的用于显示控制等的各种电路元件的集成。在此情况下，如图12所示，接触导电柱7A形成于周边区域中，并且形成于像素基板2中的检测电路8(图中未示出)和相对基板4中的滤色器42的表面相连，由此在传感器用检测电极44和检测电路8之间形成电容耦合路径。检测信号Vdet通过该电容耦合路径从传感器用检测电极44被传输到检测电路8。但是，在此情况下，由于传感器用检测电极44处于浮空状态，所以优选的是通过高电阻10将传感器用检测电极44与地连接以避免该状态。并且从对地释放静电荷的角度看，以这种方式使传感器用检测电极44接地会带来好处。

变化例

在第二实施例中，传感器用检测电极44设于玻璃基板41的表面侧(与液晶层6相反的一侧)。但是，可以进行如下变化。

例如，如图13所示，与滤色器42相比，传感器用检测电极44设于液晶层6的一侧。

或者，如图14所示，传感器用检测电极44优选地设于玻璃基板41和滤色器42之间。在横向电场模式的情况下，当垂直方向上存在电极时，在垂直方向上施加电场，并且视角等由于液晶的上升而大大恶化。当传感器用检测电极44被设置为以例如滤色器42等电介质介于其间时，该问题得到极大改善。在此情况下，例如，如图15所示，形成于像素基板2中的检测电路8(图中未示出)和相对基板4中的传感器用检测电极44通过接触导电柱7B相连。由此，导电路径形成于传感器用检测电极44和检测电路8之间，并且检测信号Vdet通过该导电路径从传感器用检测电极44被传输到检测电路8。

第三实施例

在上述第一实施例和第二实施例中，传感器用检测电极44设于显示区域中。但是，在本实施例中，如图16和图17所示，传感器用检测电极44设于围绕显示区域D的区域(框架区域F)中。图17示出了本实施例的具有触摸传感器的显示装置的平面结构，图16示出了从图17中A-A箭头的方向所视的结构。

在该具有触摸传感器的显示装置中，公共电极43和传感器用检测电极44都形成于像素基板2B侧，公共电极43和传感器用检测电极44都不形成于相对基板4侧。具体地，公共电极43形成于整个显示区域D的TFT基板21上。另外，传感器用检测电极44只形成于框架区域F的TFT基板21上。传感器用检测电极44形成为多个单独的电极组。各单独的电极例如被分配为与显示应用的各种功能相对应的操作按钮。传感器用检测电极44中的各单独的电极通过TFT50的源极和漏极与用于传感器的检测信号线51相连，该TFT50通过来自于扫描信号线52的控制实现开关。扫描信号线52和TFT50与像素的驱动电路同时形成，并且被配置成依次地且时分地

扫描各单独的电极。因此，不需要分开个数的检测电路，这是极其高效的。

在这种结构的具有触摸传感器的显示装置中，传感器用检测电极44中的各单独的电极与公共电极43分开地设在与公共电极43的形成平面相同的平面上。于是，在传感器用检测电极44中的各单独的电极和公共电极43之间形成横向上的电容耦合，并且形成电容性元件C1。公共驱动信号Vcom被施加给公共电极43(在图17的示例中为整体延伸的单个电极)，并且TFT50通过扫描信号线52被依次导通。由此，检测信号Vdet从传感器用检测电极44中的各单独的电极中被时分地取出。所取出的检测信号Vdet通过用于传感器的检测信号线51被输入给具有图6所示结构的检测电路8(图16中未示出)。

在用户的手指未与相对基板4D的表面接触的情况下，该检测信号Vdet的幅度接近于常量。另外，当用户的手指接触相对基板4D的表面的任意位置(与传感器用检测电极44中的任一单独电极对应的位置)时，由手指所形成的电容性元件C2与最初形成于该触摸位置中的电容性元件C1叠加。因此，当该触摸位置被扫描时检测信号Vdet的值变小。检测电路8(图6)将该检测信号Vdet与阈值电压Vth进行比较。当检测信号Vdet等于或小于阈值电压Vth时，检测电路8将该位置判定为触摸位置。该触摸位置可以通过用扫描信号对传感器用检测电极44中的各个单独电极的扫描时间，以及通过等于或小于阈值电压Vth的检测信号Vdet的检测时间来判定。

这样，根据本实施例，由于公共电极43和传感器用检测电极44都设于像素基板2侧，所以能够容易地在形成于TFT基板21中的传感器驱动电路(图中未示出)和公共电极43之间形成公共驱动信号Vcom的传输路径，并且在传感器用检测电极44和检测电路8之间形成检测信号Vdet的传输路径，而无需在其间设置接触导电柱。因而，很容易在TFT基板21中将公共电极43、传感器用检测电极44、用于显示的电路以及用于传感器的驱动电路和检测电路集成在一起。

此外，如同本实施例，在公共电极43和传感器用检测电极44并排设置，并且由横向上的电容耦合所形成的电容性元件C1形成于公共电极43

和传感器用检测电极44之间的情况下，存在从公共电极43到TFT基板21中的电路元件(TFT50等)的噪声转移的问题。于是，为了防止该问题，如图18所示，优选的在传感器用检测电极44下方设置屏蔽电极53。但是，也可以转而使用构成金属布线和像素电极的透明电极膜作为上述的屏蔽层，而不专门设置新的特定层。

变化例

在上述第三实施例中，公共电极43和传感器用检测电极44并排地设于TFT基板21上，并且电容性元件C1由横向上的电容耦合形成。然而，与此不同，也可以由垂直方向向上的电容耦合形成电容性元件C1。例如，如图19所示，公共电极43不仅延伸到TFT基板21上的显示区域D，而且延伸到框架区域F，并且传感器用检测电极44形成为面对TFT基板21的框架区域F中的公共电极43，作为电极层的传感器用检测电极44与公共电极43处于不同的层。由此，电容性元件C1形成于公共电极43和传感器用检测电极44之间。在此情况下，设有连接传感器用检测电极44和TFT基板21的接触柱7C，由此来自于传感器用检测电极44的检测信号Vdet可以被传输到TFT基板21侧。

从第一实施例～第三实施例的说明可见，根据作为显示功能层的液晶层的类型，可以任意选择传感器用检测电极44形成于相对基板4侧或形成于像素基板2侧。因而，具有结构设计的灵活性高的优点。

以上，尽管通过一些实施例说明本发明，但本发明并不局限于这些实施例，可以进行各种变化。例如，在上述第二实施例和第三实施例中，说明了作为横向电场模式的FFS模式的液晶元件的示例。然而，与此类似，可以采用IPS模式的液晶。

在上述的各实施例中，说明了使用液晶显示元件作为显示元件的显示装置。然而，本发明也可以应用于使用例如有机EL元件的其它显示元件的显示装置。

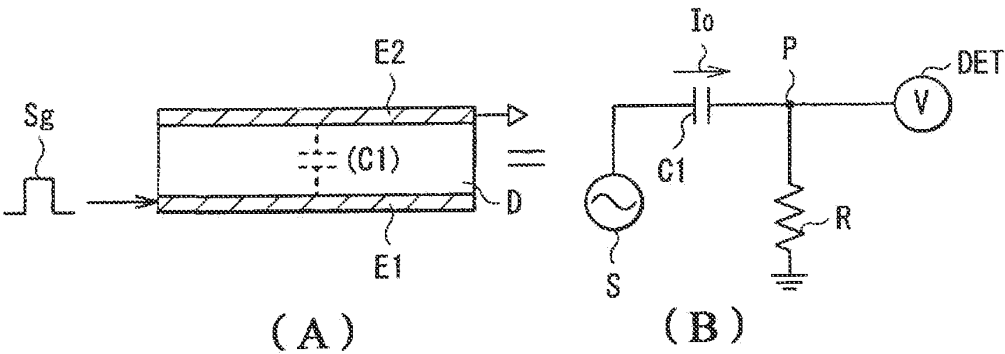


图1

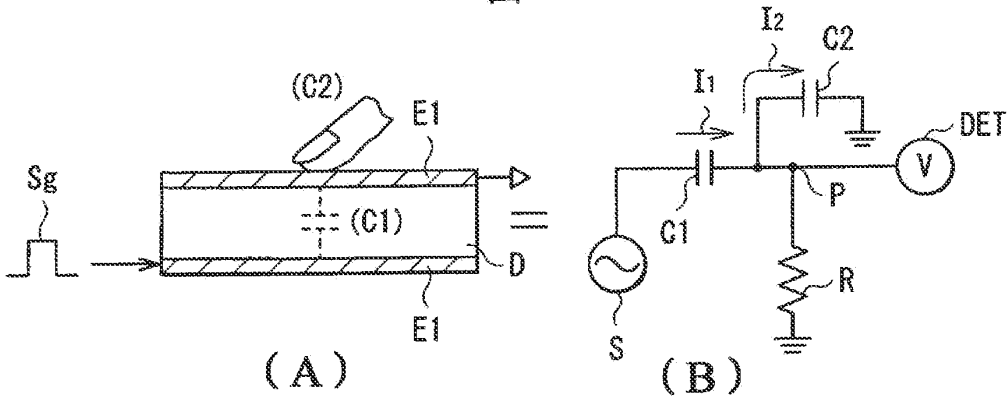


图2

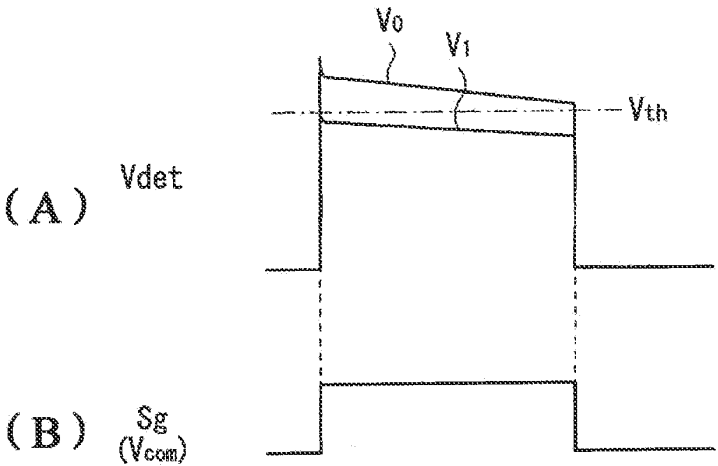


图3

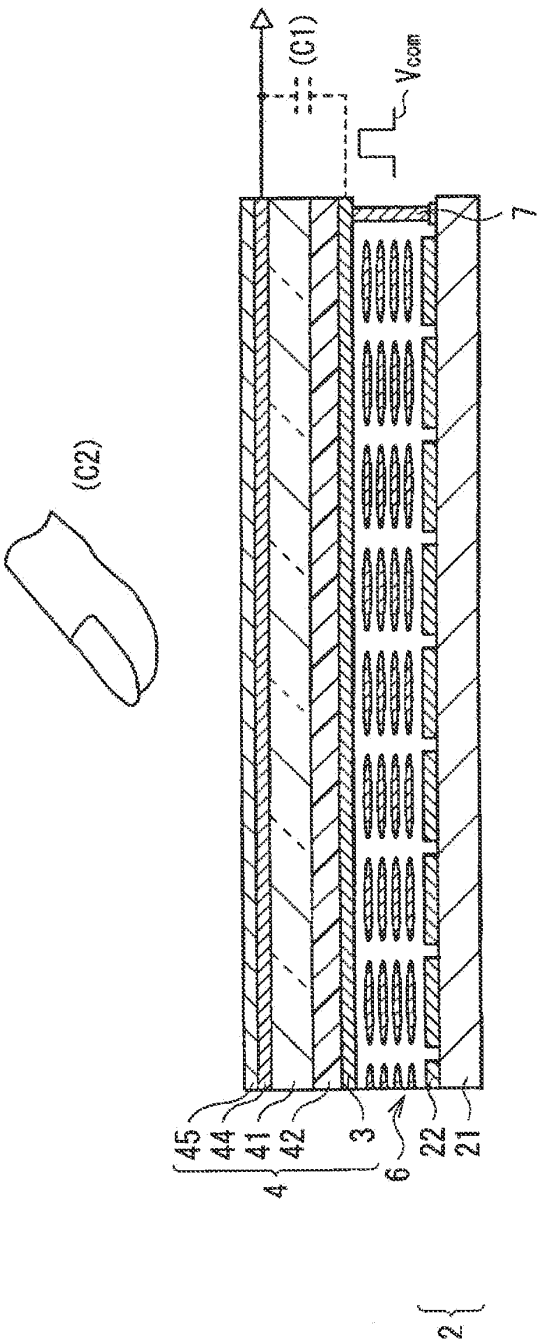


图 4

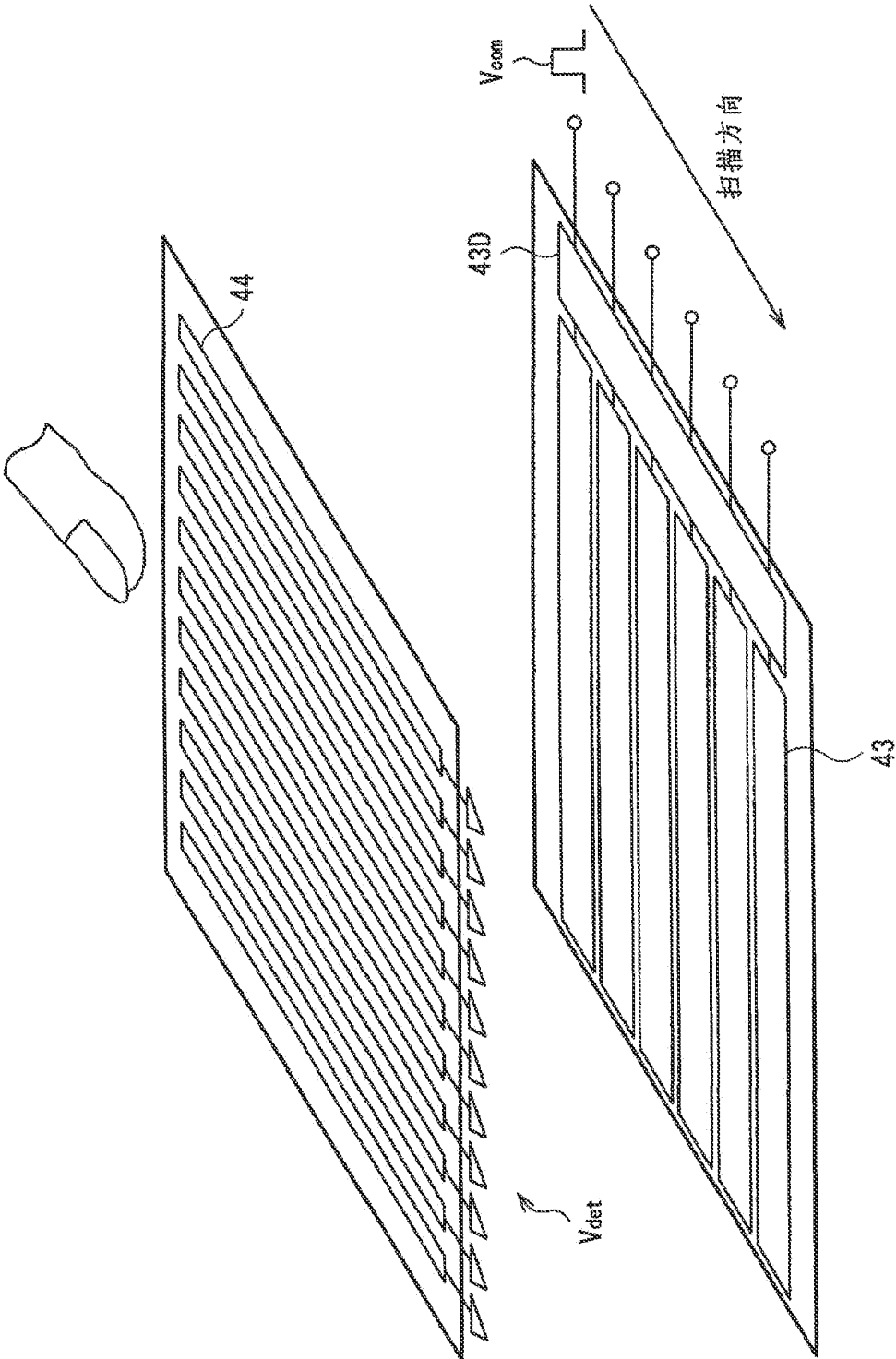


图5

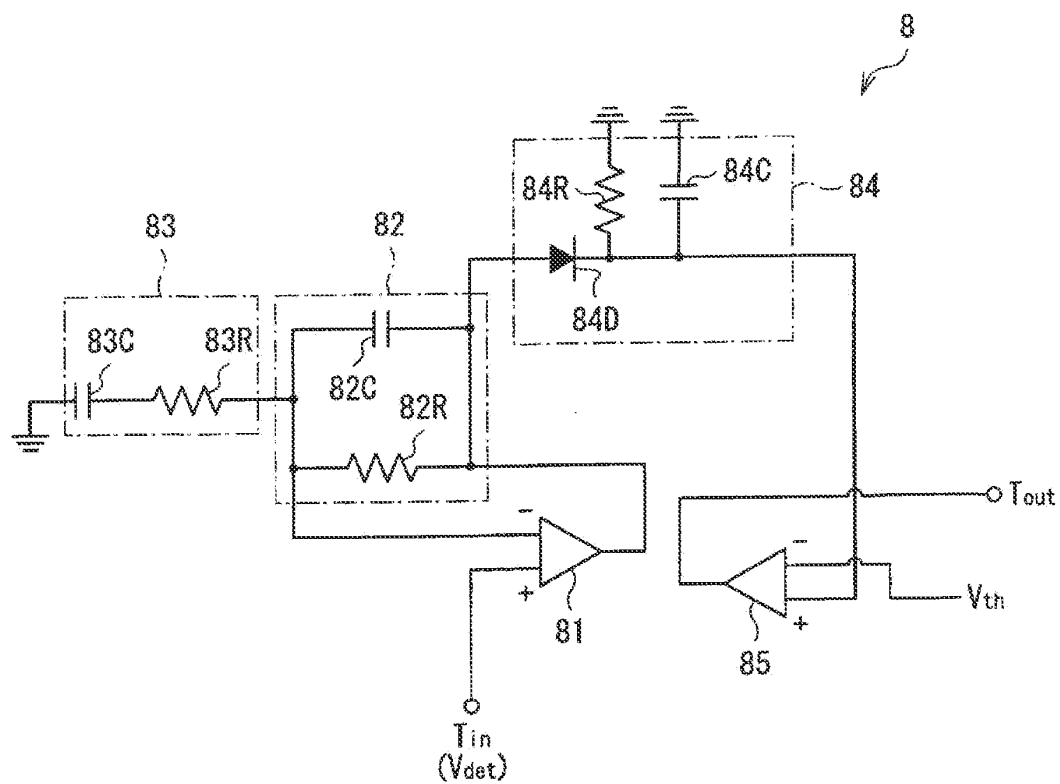
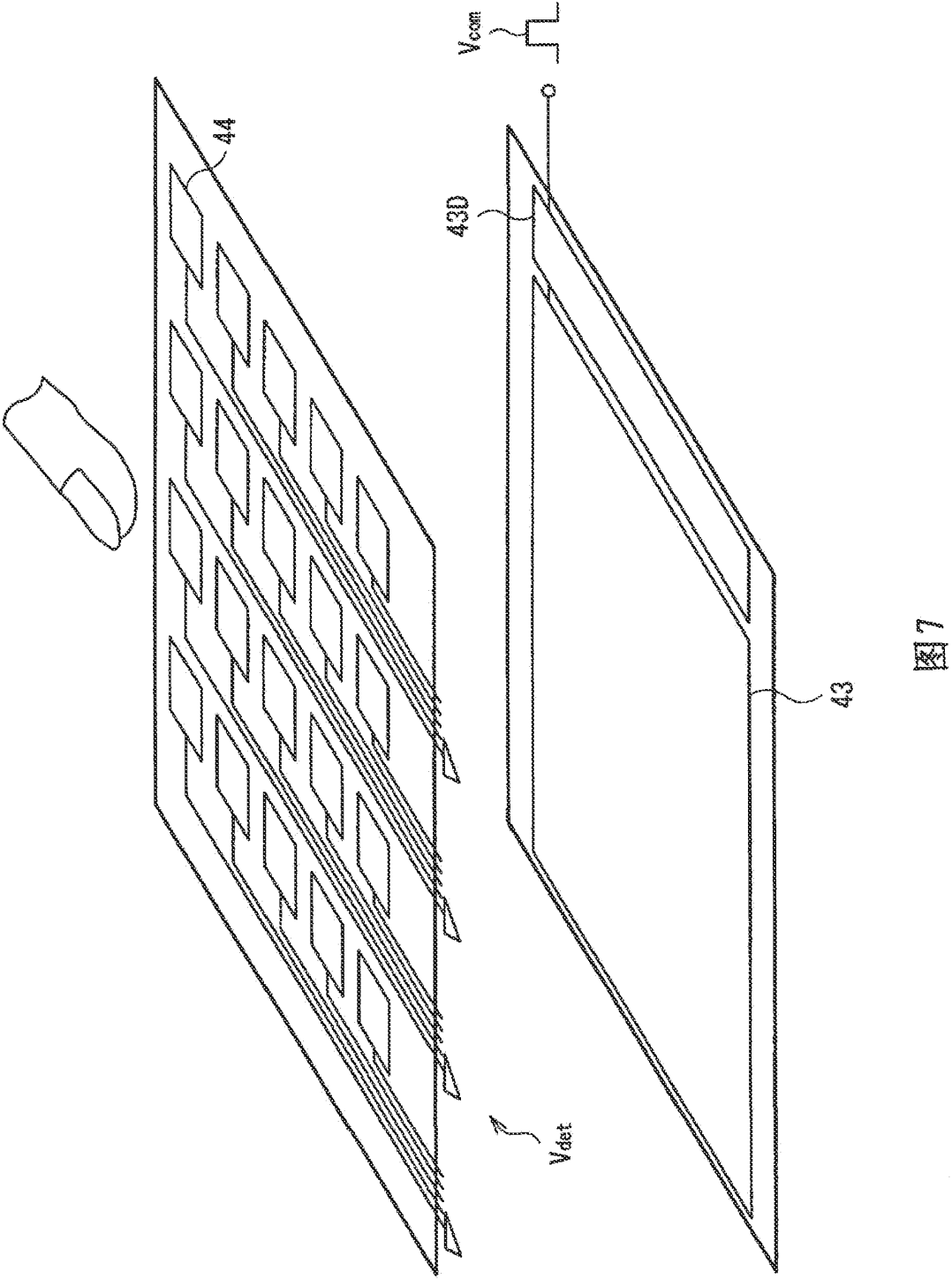


图 6



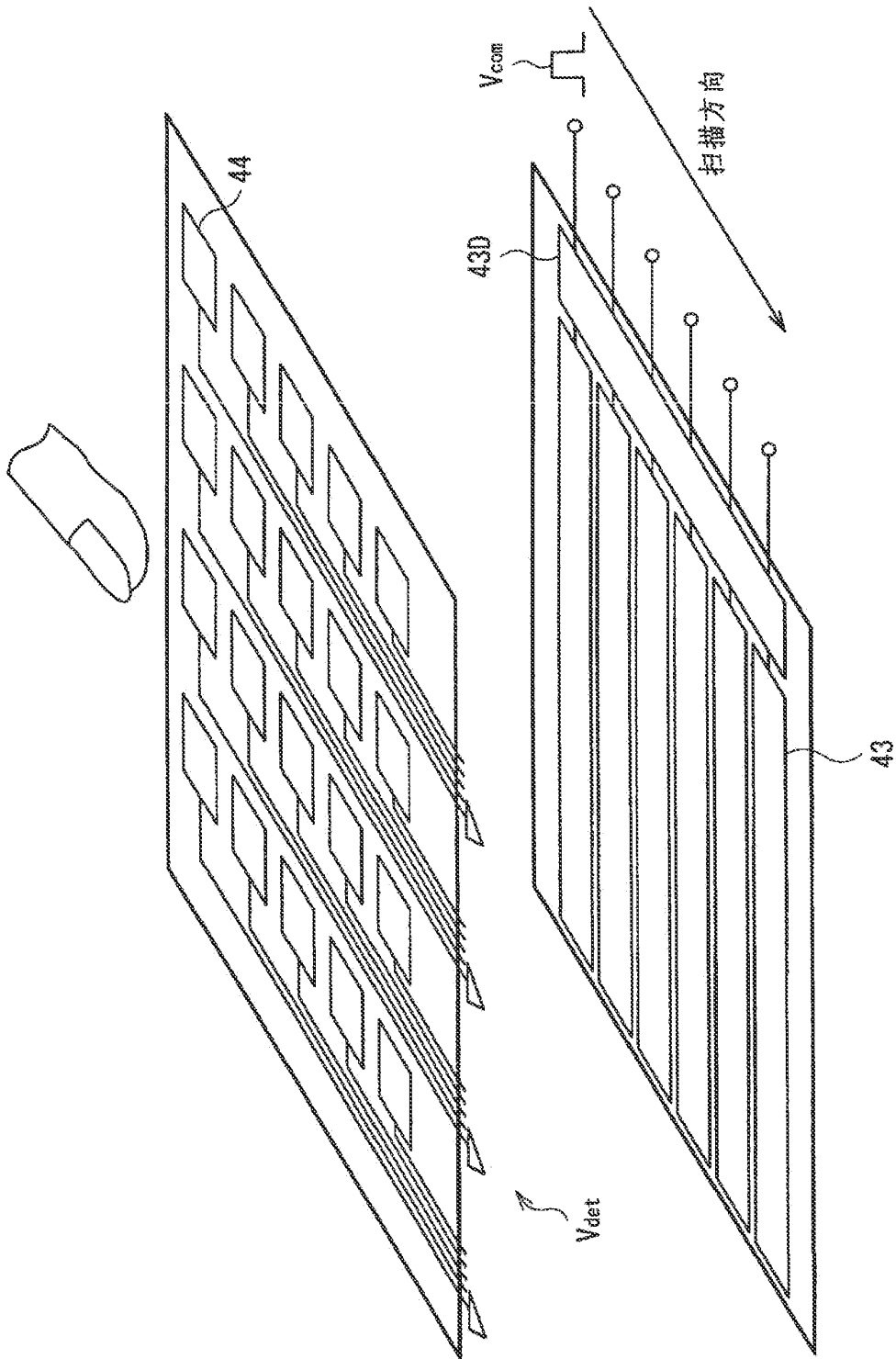


图 8

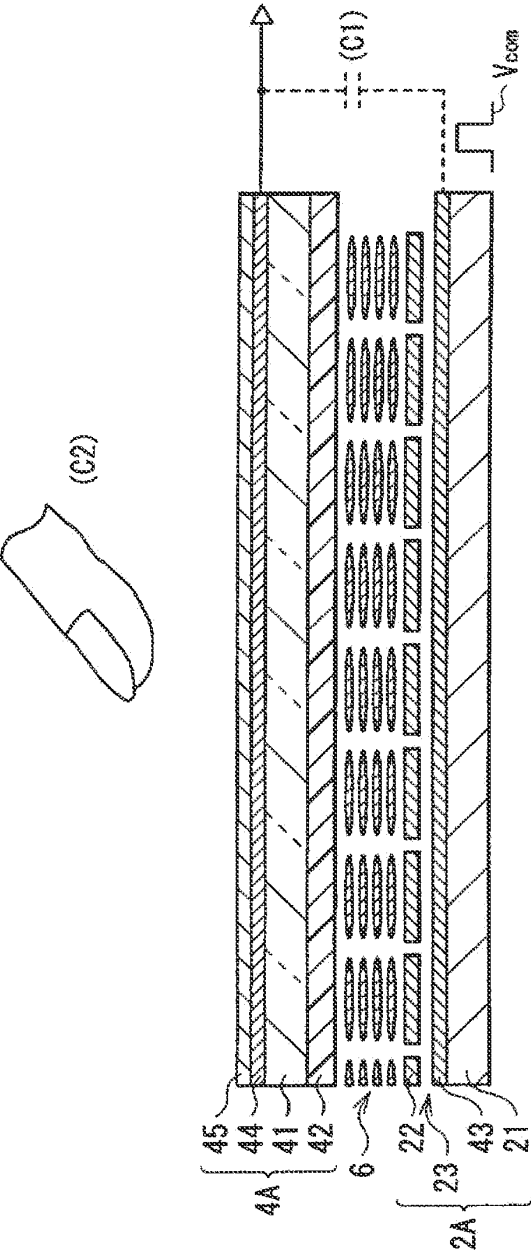


图9

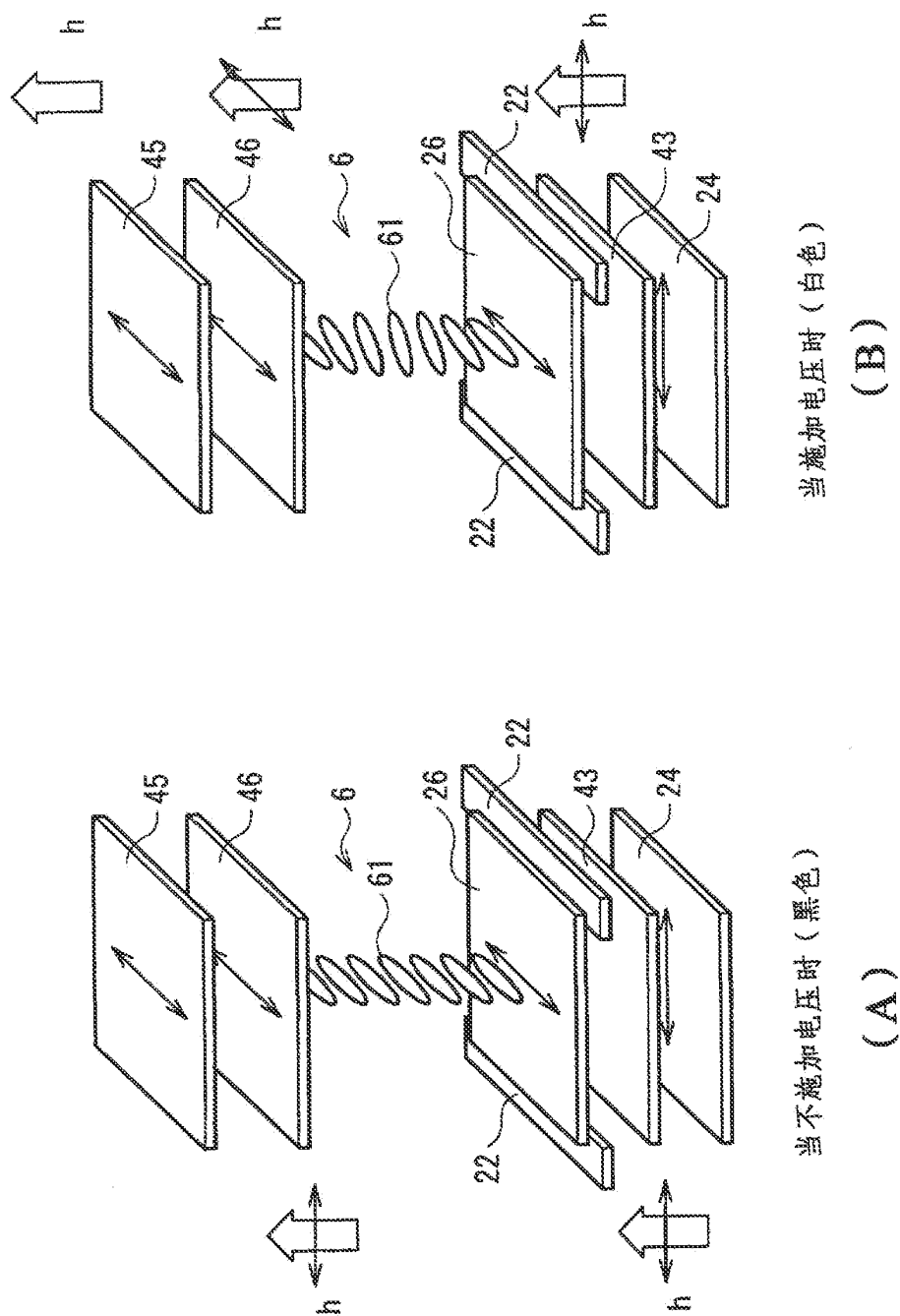


图10

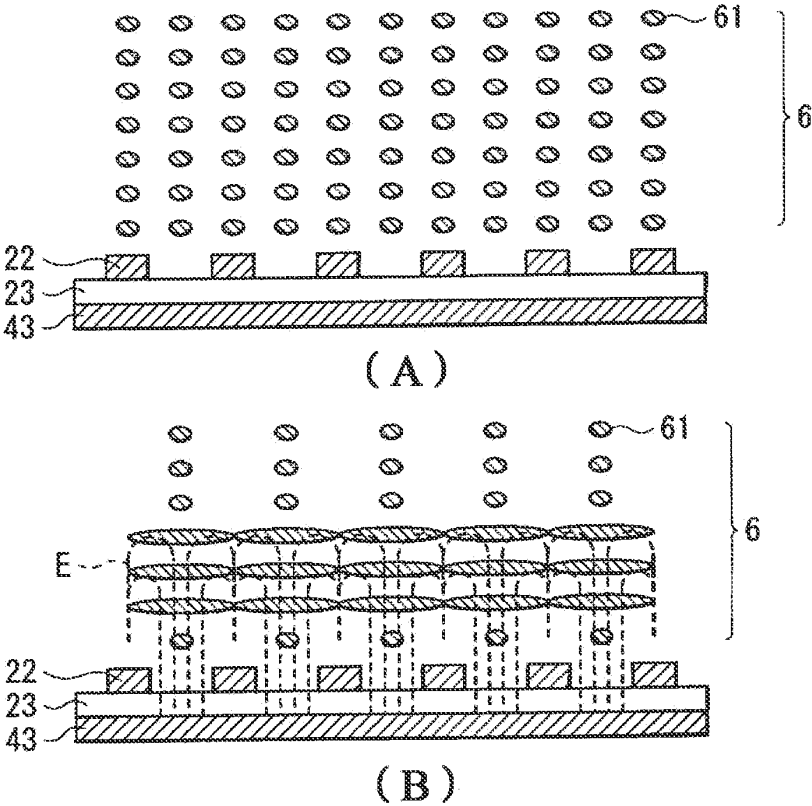


图11

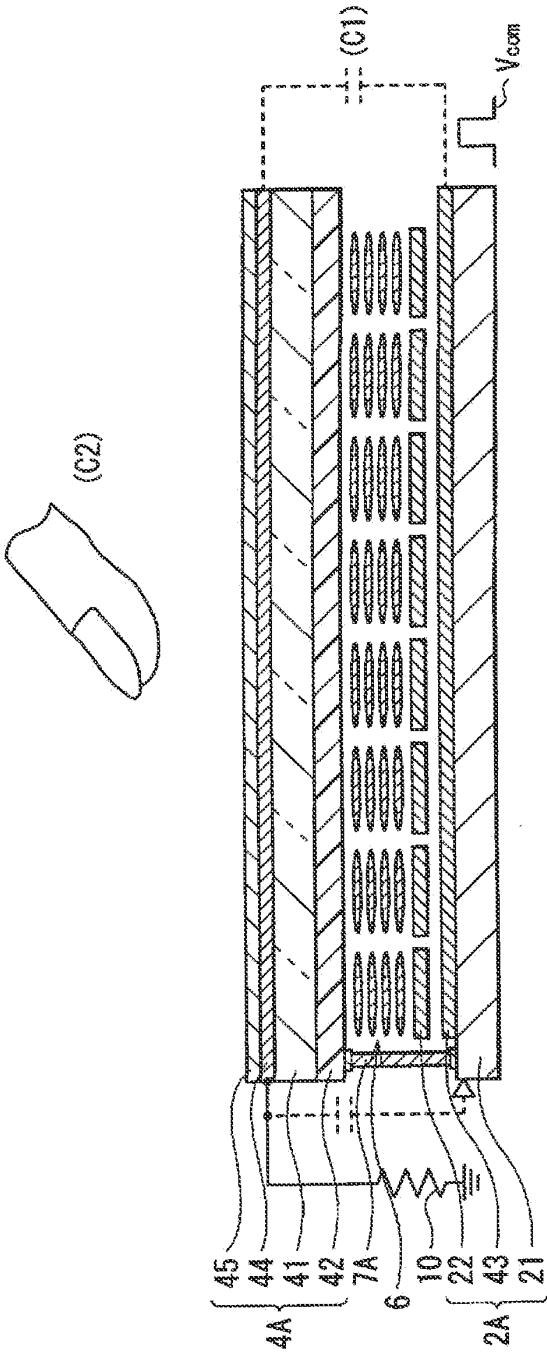
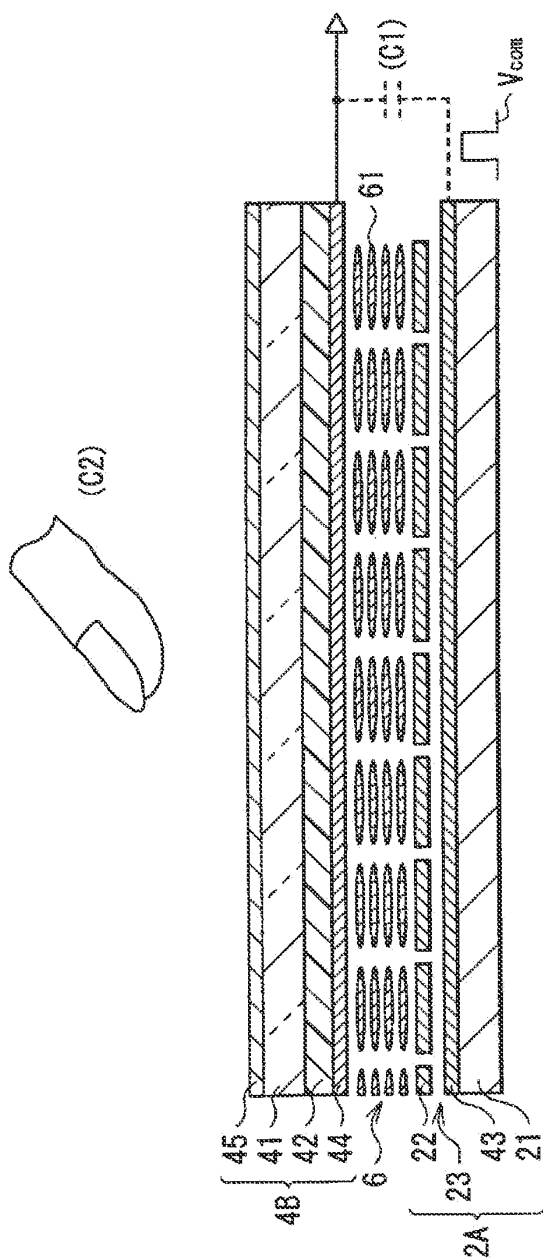
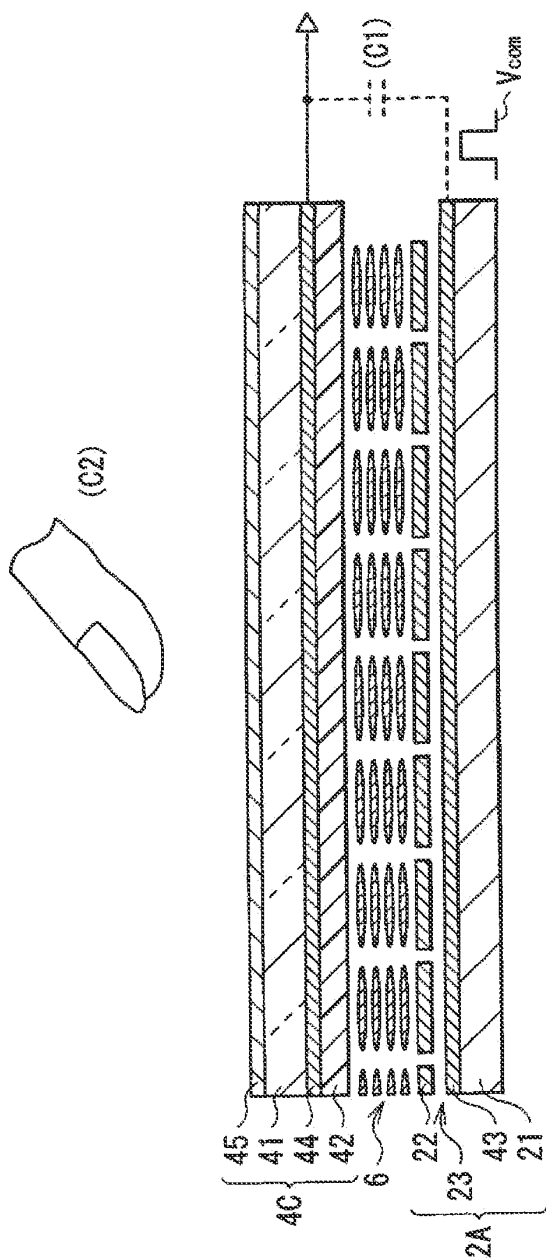


图12





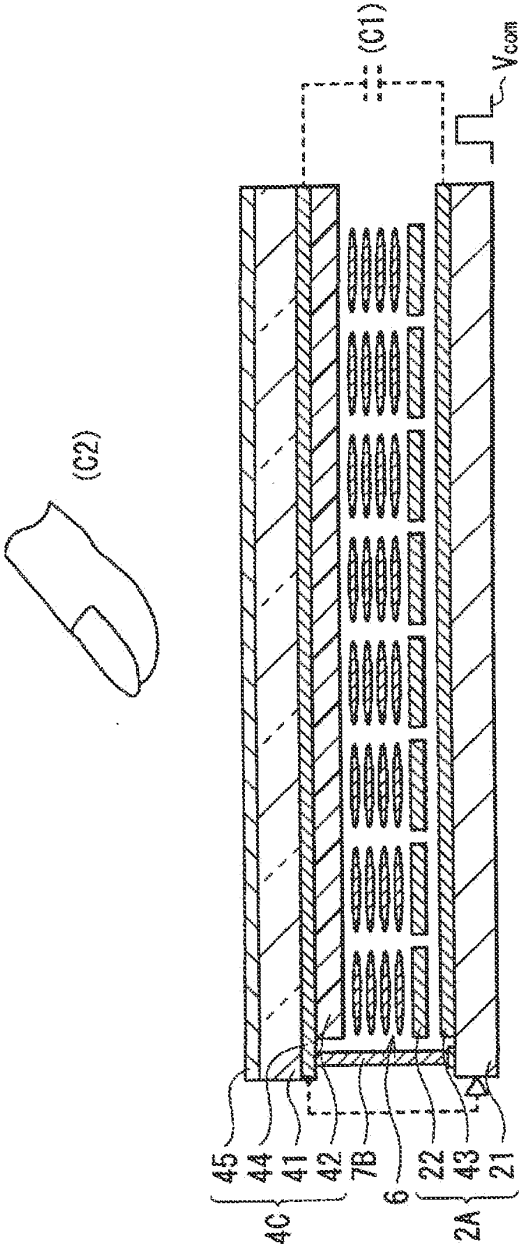


图15

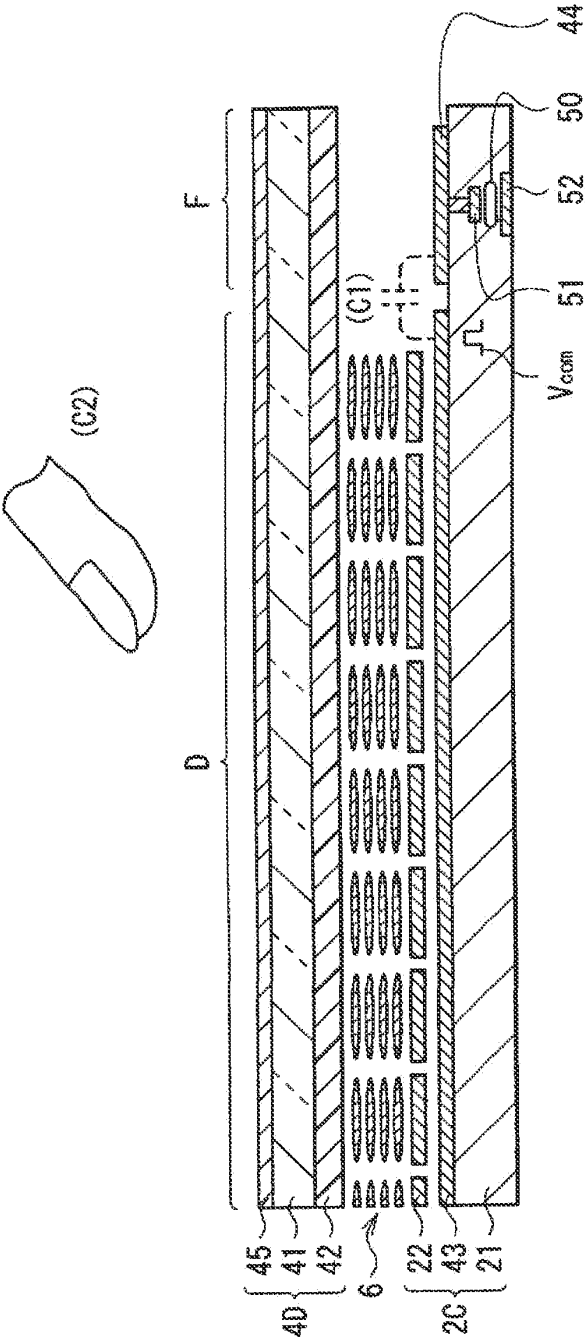


图16

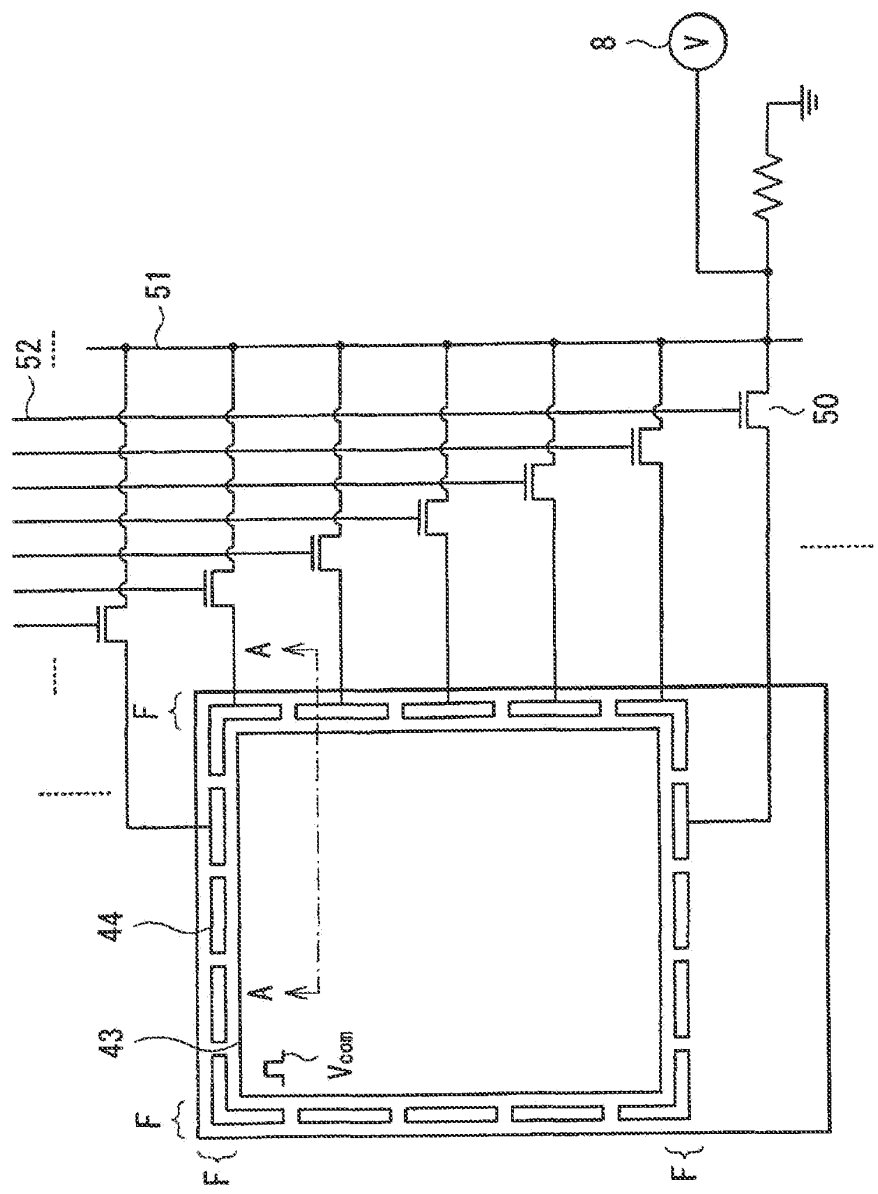


图17

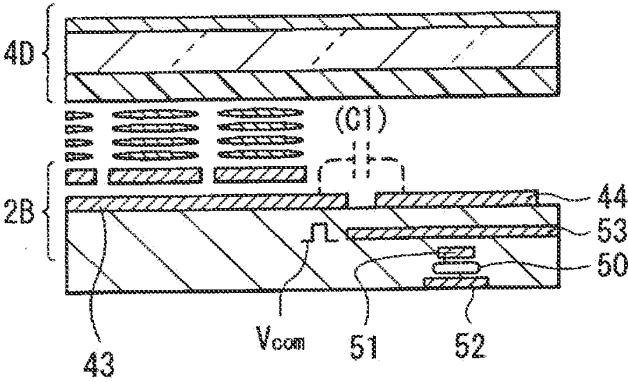


图18

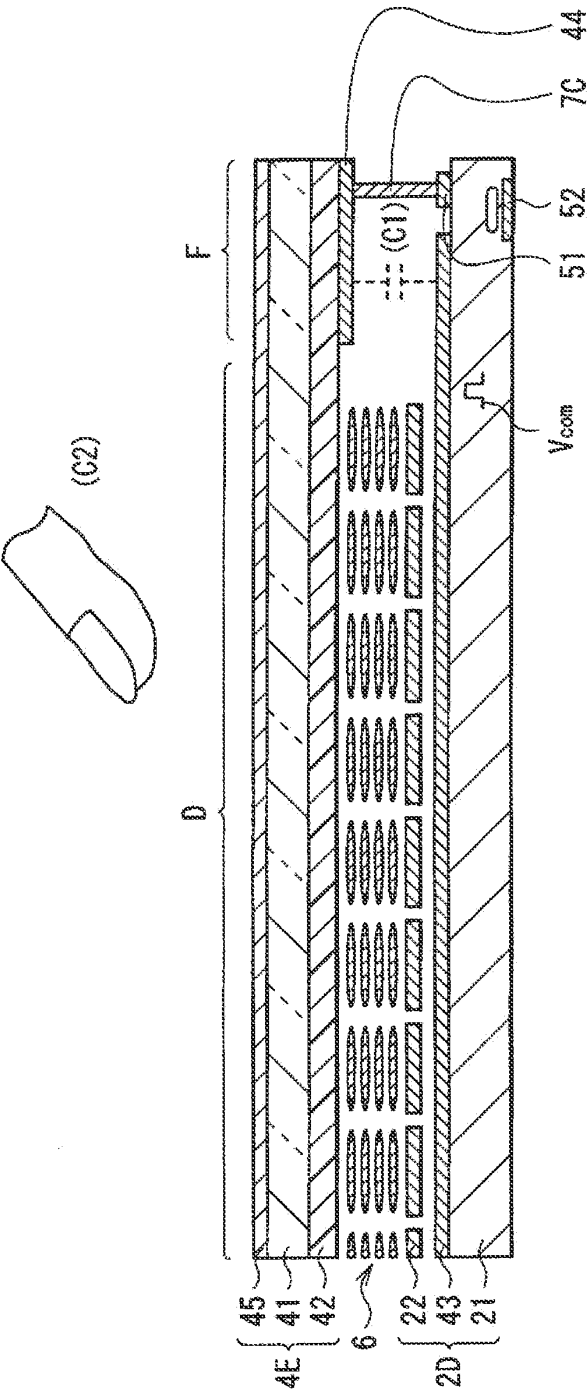


图19

PATENT
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2625

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on June 11, 2021 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.

/Sheila R. Harter/
Sheila R. Harter

Appl No. : 16/742,230 Confirmation No. 7917
Inventor : Chiwook An, et al.
Filed : January 14, 2020
Title : DISPLAY DEVICE

TC/A.U. : 2625
Examiner : Towfiq Elahl

Docket No. : 183539

Customer No. : 23363

AMENDMENT AFTER FINAL ACTION WITH AFCP 2.0 REQUEST

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
June 11, 2021

Commissioner:

This paper is in response to the Office action of April 19, 2021, which set an initial period for reply to expire on July 19, 2021. Any extension of time fee required by this paper is paid concurrently herewith. As such, this response is timely filed. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begin on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/742,230		Filing Date 01/14/2020		☐ To be Mailed				
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO												
APPLICATION AS FILED - PART I												
		(Column 1)	(Column 2)									
FOR		NUMBER FILED	NUMBER EXTRA		RATE (\$)		FEE (\$)					
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A	N/A		N/A							
☐ SEARCH FEE (37 CFR 1.16(k), (j), or (m))		N/A	N/A		N/A							
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A	N/A		N/A							
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =	*		x \$100 =							
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =	*		x \$460 =							
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).										
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))												
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL						
APPLICATION AS AMENDED - PART II												
		(Column 1)	(Column 2)		(Column 3)							
AMENDMENT	06/11/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	* 16	Minus	** 20	= 0		x \$100 =		0			
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x \$480 =		0			
	☐ Application Size Fee (37 CFR 1.16(s))											
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))											
								TOTAL ADD'L FEE		0		
AMENDMENT		(Column 1)	(Column 2)		(Column 3)							
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	*	Minus	**	=		x \$0 =					
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x \$0 =					
	☐ Application Size Fee (37 CFR 1.16(s))											
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))												
								TOTAL ADD'L FEE				
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.								LIE				
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".								/ALLYSON PURNELL/				
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".												
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.												

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc Code: A.NE.AFCP

Document Description: After Final Consideration Pilot Program Request

PTO/SB/434 (05-13)

CERTIFICATION AND REQUEST FOR CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0		
Practitioner Docket No.: <div style="font-size: 1.2em; font-weight: bold;">183539</div>	Application No.: <div style="font-size: 1.2em; font-weight: bold;">16/742,230</div>	Filing Date: <div style="font-size: 1.2em; font-weight: bold;">January 14, 2020</div>
First Named Inventor: <div style="font-size: 1.2em; font-weight: bold;">Chiwook An</div>	Title: <div style="font-size: 1.2em; font-weight: bold;">DISPLAY DEVICE</div>	
<p>APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0 (AFCP 2.0) OF THE ACCOMPANYING RESPONSE UNDER 37 CFR 1.116.</p> <ol style="list-style-type: none"> 1. The above-identified application is (i) an original utility, plant, or design nonprovisional application filed under 35 U.S.C. 111(a) [a continuing application (<i>e.g.</i>, a continuation or divisional application) is filed under 35 U.S.C. 111(a) and is eligible under (i)], or (ii) an international application that has entered the national stage in compliance with 35 U.S.C. 371(c). 2. The above-identified application contains an outstanding final rejection. 3. Submitted herewith is a response under 37 CFR 1.116 to the outstanding final rejection. The response includes an amendment to at least one independent claim, and the amendment does not broaden the scope of the independent claim in any aspect. 4. This certification and request for consideration under AFCP 2.0 is the only AFCP 2.0 certification and request filed in response to the outstanding final rejection. 5. Applicant is willing and available to participate in any interview requested by the examiner concerning the present response. 6. This certification and request is being filed electronically using the Office's electronic filing system (EFS-Web). 7. Any fees that would be necessary consistent with current practice concerning responses after final rejection under 37 CFR 1.116, <i>e.g.</i>, extension of time fees, are being concurrently filed herewith. [There is no additional fee required to request consideration under AFCP 2.0.] 8. By filing this certification and request, applicant acknowledges the following: <ul style="list-style-type: none"> • Reissue applications and reexamination proceedings are not eligible to participate in AFCP 2.0. • The examiner will verify that the AFCP 2.0 submission is compliant, <i>i.e.</i>, that the requirements of the program have been met (see items 1 to 7 above). For compliant submissions: <ul style="list-style-type: none"> ○ The examiner will review the response under 37 CFR 1.116 to determine if additional search and/or consideration (i) is necessitated by the amendment and (ii) could be completed within the time allotted under AFCP 2.0. If additional search and/or consideration is required but cannot be completed within the allotted time, the examiner will process the submission consistent with current practice concerning responses after final rejection under 37 CFR 1.116, <i>e.g.</i>, by mailing an advisory action. ○ If the examiner determines that the amendment does not necessitate additional search and/or consideration, or if the examiner determines that additional search and/or consideration is required and could be completed within the allotted time, then the examiner will consider whether the amendment places the application in condition for allowance (after completing the additional search and/or consideration, if required). If the examiner determines that the amendment does not place the application in condition for allowance, then the examiner will contact the applicant and request an interview. <ul style="list-style-type: none"> ▪ The interview will be conducted by the examiner, and if the examiner does not have negotiation authority, a primary examiner and/or supervisory patent examiner will also participate. ▪ If the applicant declines the interview, or if the interview cannot be scheduled within ten (10) calendar days from the date that the examiner first contacts the applicant, then the examiner will proceed consistent with current practice concerning responses after final rejection under 37 CFR 1.116. 		
Signature <div style="font-size: 1.2em; font-weight: bold;">/Ryan M. Swank/</div>	Date <div style="font-size: 1.2em; font-weight: bold;">June 10, 2021</div>	
Name (Print/Typed) <div style="font-size: 1.2em; font-weight: bold;">Ryan M. Swank</div>	Practitioner Registration No. <div style="font-size: 1.2em; font-weight: bold;">62,600</div>	
<p>Note: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.</p>		
<div style="display: flex; align-items: center;"> ☒ * Total of <u>1</u> forms are submitted. </div>		

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PATENT
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2625

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on June 11, 2021 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.

/Sheila R. Harter/
Sheila R. Harter

Appl No. : 16/742,230 Confirmation No. 7917
Inventor : Chiwook An, et al.
Filed : January 14, 2020
Title : DISPLAY DEVICE

TC/A.U. : 2625
Examiner : Towfiq Elahl

Docket No. : 183539

Customer No. : 23363

AMENDMENT AFTER FINAL ACTION WITH AFCP 2.0 REQUEST

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
June 11, 2021

Commissioner:

This paper is in response to the Office action of April 19, 2021, which set an initial period for reply to expire on July 19, 2021. Any extension of time fee required by this paper is paid concurrently herewith. As such, this response is timely filed. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begin on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

Appln No. 16/742,230
Amdt date June 11, 2021
Reply to Office action of April 19, 2021

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A display device comprising:
 - an organic light emitting device layer;
 - a thin film encapsulation layer on the organic light emitting device layer;
 - a buffer layer directly on the thin film encapsulation layer; and
 - a touch sensing unit directly on the buffer layer, the touch sensing unit comprising:
 - a first conductive pattern on the buffer layer;
 - an insulating layer covering the first conductive pattern; and
 - a second conductive pattern on the insulating layer, the second conductive pattern partially crossing the first conductive pattern, being electrically insulated from the first conductive pattern, and having a thickness above the first conductive pattern in a thickness direction of the display device that is greater than a thickness of the first conductive pattern in the thickness direction of the display device.
2. (Original) The display apparatus of claim 1, wherein the first conductive pattern is directly on the buffer layer.
3. (Original) The display apparatus of claim 1, wherein the buffer layer comprises at least one of a silicon nitride, a silicon-oxy-nitride, and a silicon oxide.
4. (Original) The display apparatus of claim 1, wherein the thin film encapsulation layer comprises:
 - a first inorganic layer;

Appln No. 16/742,230
Amdt date June 11, 2021
Reply to Office action of April 19, 2021

an organic layer on the first inorganic layer; and
a second inorganic layer on the organic layer.

5. (Original) The display apparatus of claim 4, wherein the buffer layer is directly on the second inorganic layer.

6. (Previously Presented) A display device comprising:
an organic light emitting device layer;
a thin film encapsulation layer on the organic light emitting device layer;
a buffer layer directly on the thin film encapsulation layer; and
a touch sensing unit directly on the buffer layer, the touch sensing unit comprising:
a first conductive pattern on the buffer layer, and comprising:
a first conductive layer on the buffer layer;
a second conductive layer on the first conductive layer; and
a third conductive layer on the second conductive layer;
an insulating layer covering the first conductive pattern; and
a second conductive pattern on the insulating layer, the second conductive pattern partially crossing the first conductive pattern, and having a thickness that is greater than a thickness of the first conductive pattern, and comprising:
a fourth conductive layer on the insulating layer;
a fifth conductive layer on the fourth conductive layer; and
a sixth conductive layer on the fifth conductive layer.

7. (Original) The display apparatus of claim 6, wherein each of the second conductive layer and the fifth conductive layer comprises aluminum (Al), and
wherein each of the first conductive layer, the third conductive layer, the fourth conductive layer and the sixth conductive layer comprises titanium (Ti).

8. (Original) The display apparatus of claim 6, wherein a thickness of the second conductive layer is greater than each of a thickness of the first conductive layer and a thickness of the third conductive layer.

9. (Original) The display apparatus of claim 6, wherein a thickness of the fifth conductive layer is greater than each of a thickness of the fifth conductive layer and a thickness of the sixth conductive layer.

10. (Original) The display apparatus of claim 6, wherein a thickness of the second conductive layer is less than a thickness of the fifth conductive layer.

11. (Original) The display apparatus of claim 6, wherein a thickness difference between the second conductive layer and the first conductive layer is greater than a thickness difference between the third conductive layer and the first conductive layer.

12. (Original) The display apparatus of claim 6, wherein a thickness difference between the fifth conductive layer and the fourth conductive layer is greater than a thickness difference between the sixth conductive layer and the fourth conductive layer.

13. (Original) The display apparatus of claim 6, wherein a thickness difference between the fifth conductive layer and the fourth conductive layer is greater than a thickness difference between the second conductive layer and the first conductive layer.

Appln No. 16/742,230
Amdt date June 11, 2021
Reply to Office action of April 19, 2021

14. (Original) The display apparatus of claim 1, wherein the second conductive pattern comprises:
first touch sensor parts;
second touch sensor parts spaced from the first touch sensor parts; and
first connection parts connecting respective ones of the first touch sensor parts,
wherein the first conductive pattern comprises electrically conductive second connection parts connecting respective ones of the second touch sensor parts.

15. (Original) The display apparatus of claim 14, wherein the second connection parts are directly on the buffer layer.

16. (Original) The display apparatus of claim 1, wherein a thickness of the insulating layer is less than a thickness of the second conductive pattern.

Appln No. 16/742,230
Amdt date June 11, 2021
Reply to Office action of April 19, 2021

REMARKS/ARGUMENTS

Claims 1-16 are pending in the instant application, of which claims 1 and 6 are independent. Claim 1 is amended herein. No new matter is added. In view of the amendments and remarks that follow, Applicant respectfully requests allowance of claims 1-16.

1. **Non-Statutory Double Patenting Rejection**

Claim 1

Claim 1 rejected on the ground of non-statutory double patenting as being unpatentable over claim 1 and claim 4 of U.S. Patent No. 10,541,279 in view of Kwon (US 20140232956).

Because the final claim scope of the claims in the present application has not been determined, and also because Applicant has amended Claim 1, Applicant reserves the right to file a future terminal disclaimer, or to argue that the claims of the present application are ultimately patentably distinct over claims 1 and 4 of U.S. Patent No. 10,541,279 in view of Kwon (US 20140232956).

2. **Claim Rejections Under 35 U.S.C. § 103**

Claims 1-5, 14 and 15

Claim 1-5, 14-15 is/are rejected under 35 U.S.C. 103 as allegedly being unpatentable over Zhu (US 20160313837) in view of Kwon (US 20140232956) and Kim (US 20150185911).

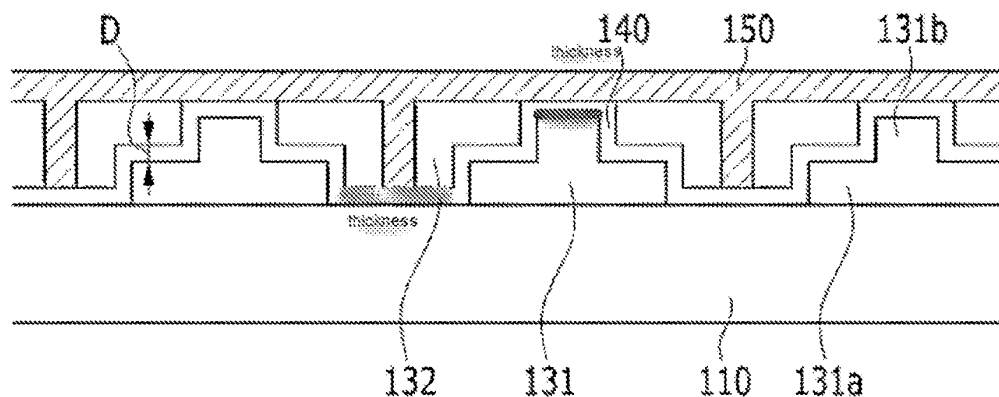
With respect to the 103 rejections of the claims, to establish a *prima facie* case of obviousness, there should be provided some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness demonstrating why one of ordinary skill in the art prior to the effective filing date of the present application would have combined the disclosures of these references to arrive at the claimed embodiment. Furthermore, there should be some explanation why any differences

Appln No. 16/742,230
Amdt date June 11, 2021
Reply to Office action of April 19, 2021

between the prior art and the claimed invention would have been obvious to one of ordinary skill in the art.

In rejecting claim 1, pages 7-8 of the Office action state that Kim allegedly teaches “the second conductive pattern (fig. 3: **second conductive pattern 132**) partially crossing the first conductive pattern (fig. 31 **first conductive pattern 131** L. being electrical!): insulated from the first conductive pattern, and having a thickness that is greater than a thickness of the first conductive pattern (fig. 3 see below for thickness in red and purple),” while referring to the annotated version of FIG. 3 of Kim produced below.

FIG. 3



Applicant has amended claim 1 to recite, in relevant part (**emphasis** added), “the **second conductive pattern** partially crossing the first conductive pattern, being electrically insulated from the first conductive pattern, and **having a thickness** above the first conductive pattern **in a thickness direction of the display device** that is **greater than a thickness of the first conductive pattern in the thickness direction of the display device.**”

Appln No. 16/742,230
Amdt date June 11, 2021
Reply to Office action of April 19, 2021

Because the thickness direction indicated in the annotated version of FIG. 3 of Kim provided on page 8 of the Office action appears to be orthogonal to, or perpendicular to, the thickness direction of the touch panel, Kim does not appear to disclose “the second conductive pattern... having a thickness... in a thickness direction of the display device that is greater than a thickness of the first conductive pattern in the thickness direction of the display device,” as now recited in claim 1.

Applicant respectfully submits that the cited references do not appear to cure the deficiencies of Kim to teach or suggest the abovementioned features of claim 1. Accordingly, it appears that the references, whether taken alone or in combination, fail to disclose the features now recited in amended claim 1. Applicant, therefore, respectfully submits that there is no apparent reason why one of ordinary skill in the art prior to the effective filing date of the present application would have combined the disclosures of the cited references to arrive at the claimed embodiment of claim 1, and that this claim would not have been obvious over the art of record to one skilled in the art at the time prior to the effective filing date of the present application.

Furthermore, because claims 2-5 and 14-16 depend from claim 1, and because claims 7-13 depend from claim 6, they each incorporate all of the terms and features of their base claim, in addition to other features, which together further patentably distinguish these claims over the art of record when considered as a whole. Therefore, Applicant requests that the rejections of these claims also be withdrawn, and that these claims be allowed as well.

3. **Allowable Subject Matter**

Claims 6-13

Applicant wishes to thank the Examiner for indicating that claims 6-13 are allowed.

4. **Concluding Remarks**

In view of the foregoing amendments and remarks, Applicant earnestly solicits a timely issuance of a Notice of Allowance with claims 1-16. If there are any remaining

Appln No. 16/742,230
Amdt date June 11, 2021
Reply to Office action of April 19, 2021

issues that can be addressed over the telephone, the Examiner is cordially invited to call Applicant's attorney at the number listed below.

Payment of any fee required to enter and process this response is provided. The Director is authorized to charge any underpayment of fees or credit any overpayment of fees to Deposit Account No. 03-1728.

Respectfully submitted,
LEWIS ROCA ROTHGERBER CHRISTIE LLP

By /Ryan M. Swank/
Ryan M. Swank
Reg. No. 62,600
626/795-9900

RMS/srh

Electronic Acknowledgement Receipt	
EFS ID:	42968584
Application Number:	16742230
International Application Number:	
Confirmation Number:	7917
Title of Invention:	DISPLAY DEVICE
First Named Inventor/Applicant Name:	Chiwook AN
Customer Number:	23363
Filer:	Ryan Matthew Swank/Sheila Harter
Filer Authorized By:	Ryan Matthew Swank
Attorney Docket Number:	183539/411598-04552
Receipt Date:	11-JUN-2021
Filing Date:	14-JAN-2020
Time Stamp:	17:21:07
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	After Final Consideration Program Request	183539AFCP.pdf	239605 c6795bbe41f1404343e4efc1a34df65c2d68b56d	no	2

Warnings:

Information:					
2		183539AAF.pdf	314495	yes	9
			d86d48e7f392533e5c2817a7aab3b3e569dd71f28		
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Response After Final Action		1	1	
	Claims		2	5	
	Applicant Arguments/Remarks Made in an Amendment		6	9	
Warnings:					
Information:					
Total Files Size (in bytes):			554100		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/742,230	01/14/2020	Chiwook AN	183539/411598-04552	7917
23363	7590	06/28/2021	EXAMINER	
Lewis Roca Rothgerber Christie LLP			ELAHI, TOWFIQ	
PO BOX 29001			ART UNIT	
Glendale, CA 91209-9001			PAPER NUMBER	
			2625	
			NOTIFICATION DATE	
			DELIVERY MODE	
			06/28/2021	
			ELECTRONIC	

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PLPrivatePair@lrrc.com
pto@lewisroca.com

Advisory Action Before the Filing of an Appeal Brief	Application No. 16/742,230	Applicant(s) AN et al.	
	Examiner TOWFIQ ELAHI	Art Unit 2625	AIA (FITF) Status Yes

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 11 June 2021 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:

a) ☐ The period for reply expires ____ months from the mailing date of the final rejection.

b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires ____ months from the mailing date of the prior Advisory Action or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANTS FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because

a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);

b) ☐ They raise the issue of new matter (see NOTE below);

c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or

d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

NOTE: _____ (See 37CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).

5. ☐ Applicants reply has overcome the following rejection(s): _____

6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☒ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____

9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).

10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).

11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because:
See continuation sheet.

13. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08) Paper No(s). _____

14. ☒ Other: PTO-2323.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
 Claim(s) allowed: 6-13.
 Claim(s) objected to: _____.
 Claim(s) rejected: 1-5 and 14-16.
 Claim(s) withdrawn from consideration: _____.

/TOWFIQ ELAHI/ Primary Examiner, Art Unit 2625	
---	--

Applicant has amended the independent claims, which raises new issues and would require further search and consideration to determine patentability.

After final amendment submitted with the request will not be treated under AFCP 2.0.

The after final amendment cannot be reviewed and a search conducted within the guidelines of the pilot program.

The after final amendment will be treated under pre-pilot procedure.

<h2 style="margin: 0;">AFCP 2.0 Decision</h2>	Application No. 16/742,230	Applicant(s) AN et al.	
	Examiner TOWFIQ ELAHI	Art Unit 2625	AIA (FITF) Status Yes

This is in response to the After Final Consideration Pilot request filed 11 June 2021.

1. **Improper Request** – The AFCP 2.0 request is improper for the following reason(s) and the after final amendment submitted with the request will be treated under pre-pilot procedure.

☐ An AFCP 2.0 request form PTO/SB/434 (or equivalent document) was not submitted.
☐ A non-broadening amendment to at least one independent claim was not submitted.
☐ The request is not the first proper AFCP 2.0 request submitted in response to the most recent final rejection.
☐ Other: _____

2. **Proper Request**

A. After final amendment submitted with the request will not be treated under AFCP 2.0.
 The after final amendment cannot be reviewed and a search conducted within the guidelines of the pilot program.
☒ The after final amendment will be treated under pre-pilot procedure.

B. Updated search and/or completed additional consideration.
 The examiner performed an updated search and/or completed additional consideration of the after final amendment within the time authorized for the pilot program. The result(s) of the updated search and/or completed additional consideration are:

☐ 1. All of the rejections in the most recent final Office action are overcome and a Notice of Allowance is issued herewith.
☐ 2. The after final amendment would not overcome all of the rejections in the most recent final Office action. See attached interview summary for further details.
☐ 3. The after final amendment was reviewed, and it raises a new issue(s). See attached interview summary for further details.
☐ 4. The after final amendment raises new issues, but would overcome all of the rejections in the most recent final Office action. A decision on determining allowability could not be made within the guidelines of the pilot. See attached interview summary for further details, including any newly discovered prior art.
☐ 5. Other: _____

Examiner Note: Please attach an interview summary when necessary as described above.

DO NOT ENTER: /T.E/

06/22/2021

PATENT
RESPONSE UNDER 37 CFR 1.116
EXPEDITED PROCEDURE
EXAMINING GROUP 2625

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

I hereby certify that this correspondence is being EFS-Web transmitted to the United States Patent and Trademark Office on June 11, 2021 at or before 11:59 p.m. Pacific Time under the Rules of 37 CFR § 1.8.

/Sheila R. Harter/
Sheila R. Harter

Appl No. : 16/742,230
Inventor : Chiwook An, et al.
Filed : January 14, 2020
Title : DISPLAY DEVICE

Confirmation No. 7917

TC/A.U. : 2625
Examiner : Towfiq Elahl

Docket No. : 183539

Customer No. : 23363

AMENDMENT AFTER FINAL ACTION WITH AFCP 2.0 REQUEST

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Post Office Box 29001
Glendale, CA 91209-9001
June 11, 2021

Commissioner:

This paper is in response to the Office action of April 19, 2021, which set an initial period for reply to expire on July 19, 2021. Any extension of time fee required by this paper is paid concurrently herewith. As such, this response is timely filed. Please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begin on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

-1-

C:\NRPorbl\FIRM\RMS\114273171_2.docx

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.E/

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/742,230		Filing Date 01/14/2020		☐ To be Mailed		
ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO										
APPLICATION AS FILED - PART I										
		(Column 1)			(Column 2)					
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)		
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (j), or (m))		N/A		N/A		N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A				
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 =		*		x \$100 =				
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 =		*		x \$460 =				
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).								
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))										
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL				
APPLICATION AS AMENDED - PART II										
		(Column 1)			(Column 2)	(Column 3)				
AMENDMENT	07/06/2021	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	* 16	Minus	** 20	= 0	x \$100 =		0		
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0	x \$480 =		0		
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
								TOTAL ADD'L FEE		0
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)		ADDITIONAL FEE (\$)		
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$0 =				
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$0 =				
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))									
								TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.								LIE		
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".								/TRINA RIDDICK/		
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".										
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.										

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL (Submitted Only via EFS-Web)

Application Number	16/742,230	Filing Date	2020-01-14	Docket Number (if applicable)	183539/411598-04552	Art Unit	2625
First Named Inventor	Chiwook AN			Examiner Name	ELAHI, TOWFIQ		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

- ☒ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____
- ☐ Enclosed
- ☐ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

- ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____.
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)
- ☐ Other _____

FEES

- The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
- ☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 031728

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒	Patent Practitioner Signature Applicant Signature
-------------------------------------	--

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	Jun-Young E. Jeon/	Date (YYYY-MM-DD)	2021-07-06
Name	Jun-Young E. Jeon	Registration Number	43693

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal				
Application Number:		16742230		
Filing Date:		14-Jan-2020		
Title of Invention:		DISPLAY DEVICE		
First Named Inventor/Applicant Name:		Chiwook AN		
Filer:		Jun-Young E. Jeon/Si Vuong		
Attorney Docket Number:		183539/411598-04552		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
RCE- 1ST REQUEST	1801	1	1360	1360
Total in USD (\$)				1360

Electronic Acknowledgement Receipt	
EFS ID:	43182045
Application Number:	16742230
International Application Number:	
Confirmation Number:	7917
Title of Invention:	DISPLAY DEVICE
First Named Inventor/Applicant Name:	Chiwook AN
Customer Number:	23363
Filer:	Jun-Young E. Jeon/Si Vuong
Filer Authorized By:	Jun-Young E. Jeon
Attorney Docket Number:	183539/411598-04552
Receipt Date:	06-JUL-2021
Filing Date:	14-JAN-2020
Time Stamp:	21:59:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 1360
RAM confirmation Number	E202176L59531292
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	183539_RCE_062821.pdf	701007	no	3
			bd4c0d1033831d54a57775bbed2574a5a306080		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30217	no	2
			ca5f093e41b438e13974748288ddf9fb5be23221		
Warnings:					
Information:					
Total Files Size (in bytes):			731224		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce	
Electronic Petition Request	TERMINAL DISCLAIMER TO OBTAIN A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT		
Application Number	16742230		
Filing Date	14-Jan-2020		
First Named Inventor	Chiwook AN		
Attorney Docket Number	183539/411598-04552		
Title of Invention	DISPLAY DEVICE		
☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action ☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.			
Owner		Percent Interest	
SAMSUNG DISPLAY CO., LTD.		100%	
<p>The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)</p> <p>10541279</p> <p>as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.</p> <p>In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:</p> <ul style="list-style-type: none"> - expires for failure to pay a maintenance fee; - is held unenforceable; - is found invalid by a court of competent jurisdiction; - is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321; - has all claims canceled by a reexamination certificate; - is reissued; or - is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer. <p>☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.</p>			

☐ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status: ☐ Small Entity ☐ Micro Entity ☒ Regular Undiscounted	
I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ☒ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number <u>62600</u> ☐ A sole inventor ☐ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ☐ A joint inventor; all of whom are signing this request	
Signature	/Ryan M. Swank/
Name	Ryan M. Swank

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
 Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal				
Application Number:		16742230		
Filing Date:		14-Jan-2020		
Title of Invention:		DISPLAY DEVICE		
First Named Inventor/Applicant Name:		Chiwook AN		
Filer:		Ryan Matthew Swank/Sheila Harter		
Attorney Docket Number:		183539/411598-04552		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	170	170
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				170

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16742230

Filing Date: 14-Jan-2020

Applicant/Patent under Reexamination: AN

Electronic Terminal Disclaimer filed on September 7, 2021

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt	
EFS ID:	43700024
Application Number:	16742230
International Application Number:	
Confirmation Number:	7917
Title of Invention:	DISPLAY DEVICE
First Named Inventor/Applicant Name:	Chiwook AN
Customer Number:	23363
Filer:	Ryan Matthew Swank/Sheila Harter
Filer Authorized By:	Ryan Matthew Swank
Attorney Docket Number:	183539/411598-04552
Receipt Date:	07-SEP-2021
Filing Date:	14-JAN-2020
Time Stamp:	17:02:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 170
RAM confirmation Number	E202197H02211428
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	41171	no	2
			ffb8f52002ac5de84f1991ea82a8521b4548811f7		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	37740	no	2
			998d6aaa810c3cc7467a3ec0f4dbfc145399053c		
Warnings:					
Information:					
Total Files Size (in bytes):			78911		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

23363 7590 09/15/2021
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

EXAMINER

ELAHI, TOWFIQ

ART UNIT

PAPER NUMBER

2625

DATE MAILED: 09/15/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/742,230	01/14/2020	Chiwook AN	183539/411598-04552	7917

TITLE OF INVENTION: DISPLAY DEVICE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	12/15/2021

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

23363 7590 09/15/2021
Lewis Roca Rothgerber Christie LLP
PO BOX 29001
Glendale, CA 91209-9001

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/742,230	01/14/2020	Chiwook AN	183539/411598-04552	7917

TITLE OF INVENTION: DISPLAY DEVICE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$1200	\$0.00	\$0.00	\$1200	12/15/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
ELAHI, TOWFIQ	2625	345-173000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies _____

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/742,230	01/14/2020	Chiwook AN	183539/411598-04552	7917
23363	7590	09/15/2021	EXAMINER	
Lewis Roca Rothgerber Christie LLP			ELAHI, TOWFIQ	
PO BOX 29001			ART UNIT	
Glendale, CA 91209-9001			PAPER NUMBER	
			2625	
DATE MAILED: 09/15/2021				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.