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United States Patent	12394644
Kind Code	B2
Date of Patent	August 19, 2025
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Electronic device comprising a transferred portion of plurality of chips and method for manufacturing the same

Abstract

A method of manufacturing an electronic device, comprising: providing a carrier substrate with a plurality of light-emitting units disposed thereon, the plurality of light-emitting units being spaced with a first pitch (P**1**) in a first direction and a second pitch (P**2**) in a second direction that is perpendicular to the first direction; providing a driving substrate; and transferring at least a portion of the plurality of light-emitting units to the driving substrate to form a transferred portion of the plurality of light-emitting units on the driving substrate, the transferred portion being spaced with a third pitch (P**3**) in a third direction and a fourth pitch (P**4**) in a fourth direction that is perpendicular to the third direction; wherein the first pitch (P**1**), the second pitch (P**2**), the third pitch (P**3**), and the fourth pitch (P**4**) are satisfied following relations: P**3**=mP**1**; and P**4**=nP**2**, m and n are positive integers.

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Appl. No.: **18/150541**

Filed: **January 05, 2023**

Prior Publication Data

Document Identifier	Publication Date
US 20230143381 A1	May. 11, 2023

Related U.S. Application Data

continuation parent-doc US 16720917 20191219 US 11574895 child-doc US 18150541

Publication Classification

Int. Cl.: **H01L21/67** (20060101); **H01L21/683** (20060101); **H01L25/075** (20060101); **H10H20/01** (20250101); **H10H20/857** (20250101); **H10H29/14** (20250101); **H10K59/12** (20230101)

U.S. Cl.:

CPC **H01L21/67144** (20130101); **H01L25/0753** (20130101); **H10H20/01** (20250101); **H10H20/857** (20250101); **H10H29/142** (20250101); **H10K59/12** (20230201); H01L21/6835 (20130101); H01L2221/68322 (20130101); H01L2221/68363 (20130101); H01L2221/68372 (20130101)

Field of Classification Search

CPC: H10K (59/12); H10H (29/142); H01L (25/0753); H01L (25/167); H01L (2221/68363); H01L (21/6835); H01L (21/68778); H01L (2221/68322); H01L (27/156); H01L (21/67144); H01L (2221/68368)

USPC: 438/22

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Background/Summary

CROSS REFERENCE TO RELATED APPLICATIONS (1) This application is a Continuation of Application Ser. No. 16/720,917, filed Dec. 19, 2019, the entirety of which is incorporated by reference herein.

BACKGROUND OF THE INVENTION
Field of the Invention
(1) The application relates in general to a method of manufacturing an electronic device, and in particular to a method that includes a step of transferring a plurality of light-emitting units.
Description of the Related Art
(2) Thanks to ongoing technological developments, recent electronic devices such as high-quality display screens usually include a plurality of LED (Light-emitting Diode) chips, which can provide 4K image quality. However, during the manufacturing of such electronic devices, the higher the desired display quality, the more LED chips are required. For example, a 4K display screen has more than 24 million LED chips. It means that there are many LED chips that need to be transferred and set on a driving substrate. Therefore, how to provide a way to efficiently transfer LED chips from a carrier substrate to a driving substrate is an important issue.
BRIEF SUMMARY OF INVENTION
(3) To address the deficiencies of conventional products, an embodiment of the disclosure provides a method of manufacturing an electronic device, comprising: providing a carrier substrate with a plurality of light-emitting units disposed thereon, the plurality of light-emitting units being spaced with a first pitch (P**1**) in a first direction and a second pitch (P**2**) in a second direction that is perpendicular to the first direction; providing a driving substrate; and transferring at least a portion of the plurality of light-emitting units to the driving substrate to form a transferred portion of the plurality of light-emitting units on the driving substrate, the transferred portion being spaced with a third pitch (P**3**) in a third direction and a fourth pitch (P**4**) in a fourth direction perpendicular to the third direction; wherein the first pitch (P**1**), the second pitch (P**2**), the third pitch (P**3**), and the fourth pitch (P**4**) are satisfied following relations: P**3**=mP**1**; and P**4**=nP**2**, m and n are positive integers.

Description

BRIEF DESCRIPTION OF DRAWINGS
(1) The disclosure can be more fully understood by reading the subsequent detailed description and examples with references made to the accompanying drawings, wherein:
(2) FIG. **1** is a schematic diagram of a system of manufacturing an electronic device according to an embodiment of the present disclosure.
(3) FIG. **2**A is a schematic diagram of a system of manufacturing an electronic device according to another embodiment of the present disclosure.
(4) FIG. **2**B is a schematic diagram of a system of manufacturing an electronic device according to another embodiment of the present disclosure.
(5) FIG. **2**C is a schematic diagram of a method of manufacturing an electronic device according to another embodiment of the present disclosure.
(6) FIGS. **3**A to **3**D are schematic diagrams of the light-emitting units transferred to the driving substrate from the carrier substrate according to another embodiment of the present disclosure.
(7) FIG. **4**A is a schematic and cross-sectional diagram of the light-emitting units, the buffer layer and the carrier substrate.
(8) FIG. **4**B is a schematic diagram of the light-emitting units having different heights.

(9) FIG. **5** is a schematic diagram of the light-emitting units transferred to the driving substrate from the carrier substrates according to another embodiment of the present disclosure.
(10) FIG. **6** is a schematic diagram of the light-emitting units transferred to the driving substrate from the carrier substrate according to another embodiment of the present disclosure.
(11) FIGS. **7**A to **7**E are schematic diagrams of the light-emitting units transferred to the driving substrate from the carrier substrates according to another embodiment of the present disclosure.

DETAILED DESCRIPTION OF INVENTION

(12) The making and using of the embodiments of the methods of manufacturing an electronic device are discussed in detail below. It should be appreciated, however, that the embodiments provide many applicable inventive concepts that can be embodied in a wide variety of specific contexts. The specific embodiments discussed are merely illustrative of specific ways to make and use the embodiments, and do not limit the scope of the disclosure.
(13) Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood to one of ordinary skill in the art to which this invention belongs. It should be appreciated that each term, which is defined in a commonly used dictionary, should be interpreted as having a meaning conforming to the relative skills and the background or the context of the present disclosure, and should not be interpreted in an idealized or overly formal manner unless defined otherwise.
(14) It should be noted that the electronic device may include a display device, an antenna device, a sensing device, or a tiled device, but is not limited thereto. The electronic device can be a bendable or flexible electronic device. The electronic device may include, for example, a light-emitting diode; the light-emitting diode may include, for example, an organic light-emitting diode (OLED), a sub-millimeter light-emitting diode (mini LED), and a micro light-emitting diode (micro LED) or a quantum dot (QD) light-emitting diode (which may be, for example, QLED or QDLED), fluorescence, phosphor, or other suitable material, and the materials thereof may be arbitrarily arranged and combined, but is not limited thereto. The antenna device can be, for example, a liquid crystal antenna, but is not limited thereto. The tiled device can be, for example, a display tiled device or an antenna tiled device, but is not limited thereto. It should be noted that the electronic device may be any combination of the foregoing, but is not limited thereto.

First Embodiment

(15) Referring to FIG. **1**, FIG. **1** is a schematic diagram of a system **100** of manufacturing an electronic device. The system **100** comprises at least one carrier substrate **11** and a driving substrate **20**. In the present embodiment, the carrier substrate **11** is a processing-transition substrate which can holds the light-emitting units **111**. The driving substrate **20** may be an AM (Active Matrix, ex. array substrate with TFT) substrate or a PM (Passive Matrix) substrate, which can be used to a substrate of a display device. A plurality of light-emitting units **111** (such as LED chips) are disposed on the carrier substrate **11**, wherein the light-emitting units **111** are transferred from the carrier substrate **11** to the driving substrate **20**, for example, by way of adhesive (e.g. carrier substrate **11** and driving substrate **20** are attached to each other) or via a gripping head (e.g. a transferring member **30** in FIG. **7**D). In some embodiments, the driving substrate **20** has stronger adhesion to the light-emitting units **111** than the carrier substrate **11**. When the carrier substrate **11** and the driving substrate **20** are attached together (with the light-emitting units **111** between them), the light-emitting units **111** can be transferred to the driving substrate **20** from the carrier substrate **11**. In some embodiments, light-emitting unit **111** may be a single color light-emitting unit, such as a red, green or blue light-emitting unit, or it can be an integrated RGB light-emitting unit.
(16) Regarding to the light-emitting units **111** on the carrier substrate **11**, the two adjacent light-emitting units **111** being spaced from each other with a first pitch P**1** in a first direction D**1** (X-axis) and a second pitch P**2** in a second direction D**2** (Y-axis) different from the first direction D**1**. In one embodiment, the second direction D**2** is perpendicular to the first direction D**1**. By using an adhesion or a gripping head, the light-emitting units **111** can be transferred and disposed on the

driving substrate **20** to form a transferred portion of the light-emitting units (transferred light-emitting units) **111**′. It should be note that the two adjacent transferred light-emitting units **111**′ is spaced from each other with a third pitch P**3** in a third direction D**3** (X-axis) and a fourth pitch P**4** in a fourth direction D**4** (Y-axis) different from the third direction D**3**. In one embodiment, the fourth direction D**4** is perpendicular to the third direction D**3**. In this embodiment, the pitches P**3** and P**4** of the light-emitting units **111**′ are respectively equal to the pitches P**1** and P**2** of the light-emitting units **111**.

(17) In some embodiments, the system **100** of manufacturing an electronic device may further comprises another carrier substrate **12**, also shown in FIG. **1**. The light-emitting units **111** and **121** on the respectively carrier substrates **11** and **12** can be transferred to the same driving substrate **20**, that is the transferred light-emitting units **111**′ and **121**′. Therefore, it means that the driving substrate **20** can carry a plurality of light-emitting units which are transferred from different carrier substrates.

(18) According to the carrier substrate area and driving substrate area for light-emitting units, and the densities of light-emitting units in carrier substrate **11** and driving substrate **20**, the amount of carrier substrates can be found by:

(19) $y*\frac{d1}{d2}=\frac{A2}{A1}$ (1)

(20) In the formula (1), “d**1**” and “d**2**” represent the “light-emitting units density on the carrier substrate” and the “light-emitting units density on the driving substrate”; “A**1**” and “A**2**” represent the “area occupied by the light-emitting units on the carrier substrate” and the “area occupied by the light-emitting units on the driving substrate area”; and “y” represents the amount of carrier substrates. Therefore, by this formula (1), the required quantity for carrier substrates can be calculated.

Second Embodiment

(21) In some embodiments, a portion of the light-emitting units **111** are transferred, and the pitches P**3** and P**4** may not totally equal to the pitches P**1** and P**2**. For example, in FIG. **2**A, the light-emitting units **111** on the carrier substrate **11** has the first pitch P**1** (X-axis) and the second pitch P**2** (Y-axis). After the light-emitting units **111** have been transferred, the transferred light-emitting units **111**′ on the driving substrate **20** has the third pitch P**3** (X-axis) and the fourth pitch P**4** (Y-axis), wherein P**3** is twice as large as P**1** (i.e. P**3**=2P**1**), and P**4** is twice as large as P**2** (i.e. P**4**=2P**2**). Therefore, by transferring the light-emitting units which are located at specific positions, the pitches (P**3** and P**4**) of the transferred light-emitting units can be adjusted.

(22) In some embodiments, as shown in FIG. **2**B, the transferred light-emitting units **111**′ on the driving substrate **20** has the third pitch P**3** (X-axis) and the fourth pitch P**4** (Y-axis), wherein P**3** is twice as large as P**1** (i.e. P**3**=2P**1**), and P**4** is same to P**2** (i.e. P**4**=P**2**). In some embodiments, the P**3** can be a positive integer multiple of P**1**, and P**4** can be a positive integer multiple of P**2**. By transferring the light-emitting units which are located at specific positions, the pitches (P**3** and P**4**) of the transferred light-emitting units can be adjusted. Therefore, by adjusting the pitches (different directions) of the transferred light-emitting units, the electronic device is more flexible in the manufacturing process which can improve the process efficiency or the product quality.

(23) According to the description of the foregoing embodiments, including the first and second embodiments, the present disclosure provides a method for manufacturing an electronic device **900**, as shown in FIG. **2**C, which mainly includes: providing a carrier substrate with a plurality of light-emitting units disposed thereon, the plurality of light-emitting units being spaced with a first pitch (P**1**) in a first direction and a second pitch (P**2**) in a second direction perpendicular to the first direction (step **902**); providing a driving substrate (step **904**); and transferring at least a portion of the plurality of light-emitting units to the driving substrate to form a transferred light-emitting units on the driving substrate, the transferred light-emitting units being spaced with a third pitch (P**3**) in a third direction and a fourth pitch (P**4**) in a fourth direction perpendicular to the third direction;

wherein the first pitch (P**1**), the second pitch (P**2**), the third pitch (P**3**), and the fourth pitch (P**4**) satisfy following relations:P**3**=mP**1**; and P**4**=nP**2**, m and n are positive integers (step **906**).

(24) In step **902**, the light-emitting units are spaced with the first and second pitches P**1** and P**2**. In step **906**, the transferred light-emitting units are spaced with the third and fourth pitches P**3** and P**4**, wherein P**3**=mP**1**; and P**4**=nP**2**, wherein m and n are positive integers. In some embodiments, m is equal to n; or m and n are all equal to 1. In some embodiments, the step of transferring at least a portion of the plurality of light-emitting units is via non-selective transferred (m and n are all equal to 1). In some embodiments, at least one of m and n is greater than 1. In some embodiments, m is different from n. In some embodiments, the step of transferring at least a portion of the plurality of light-emitting units is via selective transferred (at least one of m and n is greater than 1).

Third Embodiment

(25) FIGS. **3**A to **3**D show schematic diagrams of the light-emitting units **111** on the carrier substrate **11** undergoing a plurality of transferring processes. As shown in FIG. **3**A, a portion of the light-emitting units **111** labeled with “First transferred” are selected to be transferred to the driving substrate **20** as the first transferred light-emitting units T**1**. Then, as shown in FIG. **3**B, the other labeled “Second transferred” light-emitting units **111** are selected to be transferred to the driving substrate **20** as the second transferred light-emitting units T**2**. After then, as shown in FIGS. **3**C and **3**D, the third transferred light-emitting units T**3** and the fourth transferred light-emitting units T**4** are sequentially transferred from the carrier substrate **11** to the driving substrate **20**.

(26) By selective transferring process, the light-emitting units **111** are successfully transferred to the driving substrate **20** with the pitch P**3** in the X-axis and the pitch P**4** in the Y-axis. In this embodiment, P**3**=2P**1** and P**4**=2P**2**.

Fourth Embodiment

(27) In some embodiments, before the light-emitting unit **111** to be transferred, there is a buffer layer **1100** formed between the light-emitting units **111** and the carrier substrate **11**, as shown in FIG. **4**A. The buffer layer **1100** may comprise inorganic material or organic material. In some embodiments, the inorganic material may include, but is not limited to, silicon nitride, silicon oxide, silicon oxynitride, aluminum oxide. In some embodiments, the organic material may include, but is not limited to, epoxy resins, acrylic resins such as polymethylmetacrylate (PMMA), benzocyclobutene (BCB), polyimide, and polyester, polydimethylsiloxane (PDMS) or polyfluoroalkoxy (PFA). The buffer layer **1100**, for example, can be formed via an etching process and has a plurality of regions with different heights in a fifth direction D**5** (Z-axis).

(28) In the present embodiment, the buffer layer **1100** has a plurality of regions **1100**A to **1100**D, wherein different regions have different heights in a fifth direction D**5** (Z-axis) perpendicular to the first and second directions. In particular, as the cross-regional view along the line A-A′ (shown in FIG. **4**A), the buffer layer **1100** in the region **1100**A (between the carrier substrate **11** and the First transferred) has the largest height in the Z-axis. The heights of the buffer layer **1100** respectively in the regions **1100**B/**1100**C (between the carrier substrate **11** and the Second transferred and the Third transferred) are smaller than the height of the buffer layer **1100** in the region **1100**A. The buffer layer **1100** in the region **1100**D (between the carrier substrate **11** and the Fourth transferred) has the lowest height in the Z-axis.

(29) In some embodiments, the buffer layer can be a multi-layer structure which is provided between the light-emitting units **111** and the carrier substrate **11**, which also forms a plurality of regions with different heights in Z-axis. In some embodiments, the region **1100**D may have one buffer layer; the region **1100**C may have two buffer layers; the region **1100**B may have three buffer layers; and the region **1100**A may have four buffer layers, but is not limited thereto.

(30) With this configuration, a portion of the light-emitting units **111** on the carrier substrate **11** can easily be selected to transfer to the driving substrate **20**. For example, by way of adhesion, the two substrates **11** and **20** may be attached to each other to transfer the light-emitting units **111**, due to different heights of the buffer layer **1100** in different regions **1100**A to **1100**D, the first transferred

light-emitting units T**1** can be transferred to a specific area of the driving substrate **20**. Then the second transferred light-emitting units T**2**, the third transferred light-emitting units T**3** and the fourth transferred light-emitting units T**4** are sequentially transferred to others specific areas of the driving substrate **20**.

(31) In some embodiments, light-emitting units labeled “First transferred”, “Second transferred”, “Third transferred”, and “Fourth transferred” may have different heights in the Z-axis by different way. As shown in FIG. **4**B, light-emitting units **111** has multiple layers: a p-type semiconductor layer **1111**, a multiple quantum well (MQW) layer **1112**, an n-type semiconductor layer **1113**, and an i-type semiconductor layer **1114**, wherein the i-type semiconductor layer **1114** is located at the top portion of the light-emitting units **111**. In the present embodiment, the i-type semiconductor layer **1114** of the light-emitting unit labeled “First transferred” is thicker than the i-type semiconductor layer **1114** of the light-emitting unit labeled “Second transferred”. In the present embodiment, the i-type semiconductor layer **1114** of the light-emitting unit labeled “Second transferred” is thicker than the i-type semiconductor layer **1114** of the light-emitting unit labeled “Third transferred”. In the present embodiment, the i-type semiconductor layer **1114** of the light-emitting unit labeled “Third transferred” is thicker than the i-type semiconductor layer **1114** of the light-emitting unit labeled “Fourth transferred”. Therefore, with this configuration, it is possible to achieve an efficient transfer, which the light-emitting units can be easily to select with the different heights.

Fifth Embodiment

(32) FIG. **5** shows a plurality of the light-emitting units **111**, **121** and **131** on the carrier substrates **11**, **12** and **13** are transferred to the driving substrate **20**. The different carrier substrates **11** to **13** may sustain different types of light-emitting units. For example, the light-emitting units **111** may be (but not limit to) red light-emitting units; the light-emitting units **121** may be green light-emitting units; and the light-emitting units **131** may be blue light-emitting units. The different light-emitting units **111**, **121** and **131** are depicted with different types of diagonal lines for clarity. The selected light-emitting units **111** (or **121**, **131**) to be transferred are represented by different frame lines relative to the unselected light-emitting units **111** (or **121**, **131**).

(33) A portion of the same light-emitting units **111**(**121** or **131**) on the carrier substrate **11**(**12** or **13**) is transferred to the driving substrate **20** to become the light-emitting units **111′** (**121′** or **131′**), wherein the pitches P**1** and P**2** is less than the pitches P**3** and P**4** for same type of the light-emitting units **111**(**121** or **131**). In this embodiment, P**3**=2P**1**, and P**4**=2P**2**.

(34) In some embodiments, the light-emitting units **111** are blue light-emitting units, the light-emitting units **121** are green light-emitting units, and the light-emitting units **131** are red light-emitting units. The light-emitting units **131** are transferred to the driving substrate **20** after the light-emitting units (**111** and **121**), due to the red light-emitting units are thicker than the blue and green light-emitting units. Therefore, the situation of the impact during transfer can be effectively decreased. In this embodiment, since the transferring member **30** may select the light-emitting units (**111**, **121** and **131**) at different positions on different carrier substrates (**11**, **12** and **13**) and transfer to the driving substrate **20**, the transferring member **30** can correctly place the light-emitting units as long as the transferring member **30** correspond to a fixed position of the driving substrate **20**. Furthermore, the transferring member **30** can also select the light-emitting units (**111**, **121** and **131**) at the same position on different carrier substrates (**11**, **12** and **13**) and transfer to the driving substrate **20**. At this time, the transferring member **30** can correctly place the light-emitting units (**111**, **121** and **131**) on the driving substrate **20** as long as there is a displacement corresponding to the fixed position of the driving substrate **20**.

(35) In addition, in order to make an electronic device with a larger size, the light-emitting units can be arranged on the temporary carrier substrate by using the method in Fifth Embodiment, and then transferred to the driving substrate by using the method in First Embodiment.

Sixth Embodiment

(36) FIG. **6** illustrates the light-emitting units **111** transferred to the driving substrate **20** according to another embodiment of the present disclosure. The light-emitting units **111** include different types (such as different colors) of light-emitting units **111**R, **111**G and **111**B, which are depicted with different types of diagonal lines for clarity. The selected light-emitting units **111** to be transferred are represented by different frame lines relative to the unselected light-emitting units **111**.
(37) First, the method involves selecting a portion of the light-emitting units **111**, labeled as First transferred, including light-emitting units **111**R, **111**G and **111**B with a triangle arrangement, and being an assembled portion of the light-emitting units TT**1**, and then transferring the assembled portion of the light-emitting units TT**1** to the driving substrate **20** as the first transferred light-emitting units T**1** (including light-emitting units **111**′R, **111**′G and **111**′B), having pitches P**3**=P**1** and P**4**=P**2**. Second, the method involves selecting another portion of the light-emitting units **111**, labeled as Second transferred, including units **111**R′, **111**G′ and **111**B′, and being an assembled portion of the light-emitting units TT**2**, and then rotating the assembled portion of the light-emitting units TT**2** by 180 degrees around the rotating direction R**1** and transferring the assembled portion of the light-emitting units TT**2** to the driving substrate **20** as the second transferred light-emitting units T**2**, having pitches P**3**=P**1** and P**4**=P**2**.
(38) FIG. **6** illustrates a space S which is existed in the assembled portion of the light-emitting units TT**1** and TT**2**. If the light-emitting units via the first transfer can be divided into three times and transfers to a temporary carrier substrate respectively, the space can be removed. And then the light-emitting units on the temporary carrier substrate can be transferred to the driving substrate **20** by the transfer method as shown in First Embodiment.
Seventh Embodiment
(39) FIGS. **7**A to **7**E illustrate a way of light-emitting units **711** transferred to a driving substrate **20** according to another embodiment of the present disclosure. The light-emitting units **711** may be single color light-emitting units or integrated light-emitting units (such as RGB LED). As shown in FIG. **7**A, from a cross-section view along the line B-B′, there is a sacrificial layer **80** between a carrier substrate **71** and the light-emitting units **711**. The sacrificial layer **80** may have a taper-shaped formed through a photolithography process, and may mainly comprise a photoresist material, for example, including a positive photoresist, such as phenol-formaldehyde resin or epoxy resin, or including a negative photoresist, such as polyisoprene rubber. The sacrificial layer **80** may also be formed through a photolithography process and chemical etchant processes, which may have inorganic material, such as including (but is not limited to) silicon nitride, silicon oxide, silicon oxynitride, or aluminum oxide, or may have an organic material, such as including (but is not limited to) epoxy resins, acrylic resins such as polymethylmetacrylate (PMMA), benzocyclobutene (BCB), polyimide, and polyester, polydimethylsiloxane (PDMS), or polyfluoroalkoxy (PFA).
(40) Referring to FIG. **7**B shown as a top view and a cross-section view along the line C-C′, a holding layer **90** is provided over the light-emitting units **711** to hold the light-emitting units **711**, wherein the holding layer **90** also covers the sacrificial layer **80** and a portion surface of the carrier substrate **71** between the two adjacent light-emitting units **711**. The holding layer **90** primarily includes inorganic materials such as SiOx, SiNx, SiOxNy, AlOx, or metal.
(41) Referring to FIG. **7**C, the sacrificial layer **80** is etched in a wet etching process. The light-emitting units **711** are held by the holding layer **90**. After then, as shown in FIG. **7**D, the holding layer **90** with the light-emitting units **711** is held by a transferring member **30**. The transferring member **30** may have a vacuum adsorption head, a gripping head, a magnetic head, a viscous film (such as a PDMS (polydimethylsiloxane) soft film or a PMMA (polymethylmethacrylate) soft film), or other appropriate transferring members, and the holding layer **90** fractures at a weak portion, e.g. a neck portion (the portion that does not cover any light-emitting unit **711** in the normal direction of the carrier substrate **71**), to form a first portion **91** (grabbed by the transferring

member **30**) and a second portion **92** (still disposed on the carrier substrate **71**), and the first portion **91** of the holding layer **90** and the light-emitting units **711** are separated from the carrier substrate **71**.
(42) Referring to FIG. **7**E, the transferring member **30** places the light-emitting units **711** on the driving substrate **20**, wherein the light-emitting units **711** are connected to a conductive layer EC. A conductive test is performed via a testing member ER to identify the bonding quality of the light-emitting units **711**. In some embodiments, the lower surface of the first portion **91** may be higher than or equal to the lower surface of the electrodes **711**E of the light-emitting units **711**. And, the first portion **91** will couple to the electrodes **711**E, thereby improving product yield. After the testing is passed, the connection between the light-emitting units **711** and the conductive layer EC is covered by a package member PK, and at least a portion of the light-emitting units **711** are compassed by the package member PK. In some embodiments, the first portion **91** can be fully covered by the package member PK to achieve good encapsulation.
(43) It should be noted that the features of the various embodiments can be combined and used as long as they do not violate or conflict the scope of the disclosure.
(44) In summary, the present disclosure provides a method of manufacturing an electronic device. The embodiment of the present disclosure has at least one of the following advantages or effects. The pitches (P**3** and P**4**) can be changed, which are larger than or equal to the pitches (P**1** and P**2**). Therefore, the pitch of a large number of the light-emitting units can be rapidly adjusted, or the transfer efficiency can be increased, or the manufacturing process is improved.
(45) Use of ordinal terms such as “first”, “second”, “third”, etc., in the claims to modify a claim element does not by itself connote any priority, precedence, or order of one claim element over another or the temporal order in which acts of a method are performed, but are used merely as labels to distinguish one claim element having a certain name from another element having the same name (but for use of the ordinal term) to distinguish the claim elements.
(46) It will be apparent to those skilled in the art that various modifications and variations can be made in the disclosure. It is intended that the standard and examples be considered as exemplary only, with the true scope of the disclosed embodiments being indicated by the following claims and their equivalents.

Claims

1. A method of manufacturing an electronic device, comprising: providing a first substrate with a plurality of chips disposed thereon; providing an inorganic layer over the plurality of chips; providing a second substrate; and transferring at least a portion of the plurality of chips to the second substrate to form a transferred portion of the plurality of chips on the second substrate; wherein the inorganic layer fractures to form a first portion and a second portion, the first portion of the inorganic layer contacts at least the portion of the plurality of chips to separate from the second portion of the inorganic layer disposed on the first substrate.
2. The method of manufacturing the electronic device according to claim 1, wherein the inorganic layer comprises SiOx, SiNx, SiOxNy, AlOx, or metal.
3. The method of manufacturing the electronic device according to claim 1, wherein the first portion of the inorganic layer covers at least the portion of the plurality of chips.
4. The method of manufacturing the electronic device according to claim 1, wherein a lower surface of the first portion of the inorganic later is higher than or equal to a lower surface of an electrode of one of at least the portion of the plurality of chips.
5. An electronic device, comprising: a substrate; a conductive layer disposed on the substrate; and a plurality of transferred chips disposed on the substrate and electrically connected to the conductive layer; wherein one of the plurality of transferred chips comprises a portion of an inorganic layer and a chip, and the portion of the inorganic layer contacts the chip.

6. The electronic device according to claim 5, wherein the inorganic layer comprises SiOx, SiNx, SiOxNy, AlOx, or metal.
7. The electronic device according to claim 5, wherein the portion of the inorganic layer covers the chip.
8. The electronic device according to claim 5, wherein a lower surface of the portion of the inorganic later is higher than or equal to a lower surface of an electrode of the chip.