



and development (“R&D”) for the last two decades. Seoul Semiconductor invests over 10% of sales revenue into R&D and owns one of the largest LED patent portfolios in the world, which includes more than 10,000 patents worldwide.

### **THE PARTIES**

4. Plaintiff Seoul Semiconductor is a company organized and existing under the laws of the Republic of Korea, with its principal place of business at 1B-25, 727, Wonsi-dong, Danwon-gu, Ansan-city, Gyeonggi-do, Korea 425-851.

5. Plaintiff Seoul Viosys is a company organized and existing under the laws of the Republic of Korea, with its principal place of business at 65-16, Sandan-ro163beon-gil, Danwon-gu, Ansan-si, Gyeonggi-do, Korea 425-851.

6. On information and belief, Service Lighting and Electrical Supplies, Inc. doing business as 1000bulbs.com (“1000bulbs”) is a company organized and existing under the laws of the State of Texas with its principal place of business at 2140 Merritt Drive Garland, Texas 75041.

7. On information and belief, 1000bulbs is in the business of offering for sale, selling and distributing lighting products including light products based on light emitting diode (LED) technology.

8. Among 1000bulbs.com products are the Archipelago A19F6027-2 bulb. An images of the A19F6027-2 bulb is reproduced below.



## **JURISDICTION AND VENUE**

9. This is an action for patent infringement, under the patent laws of the United States, 35 U.S.C. § 271 *et seq.* This Court has subject matter jurisdiction under 28 U.S.C. §§1331 and 1338(a).

10. This Court has personal jurisdiction over 1000bulbs and, upon information and belief, is amenable to service via its registered agent Kim Pederson.

11. Venue is proper within this judicial district under 28 U.S.C. §1400(b) because 1000bulbs resides in this judicial district and/or 1000bulbs has committed acts of infringement in this judicial district and has a regular and established place of business within this judicial district.

## **PATENTS-IN-SUIT**

12. On April 18, 2017, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,627,435 (“the ’435 Patent”), entitled “Light Emitting Device,” to Lee *et al.* Seoul Viosys is the owner by assignment of the ’435 Patent. A true and correct copy of the ’435 Patent is attached hereto as Exhibit 1.

13. On July 28, 2015, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,093,627 (“the ’627 Patent”), entitled “Light Emitting Diode and Method of Fabricating the Same,” to Lee *et al.* Seoul Viosys is the owner by assignment of the ’627 Patent. A true and correct copy of the ’627 Patent is attached hereto as Exhibit 2.

14. On February 21, 2017, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 9,577,157 (“the ’157 Patent”), entitled “Light Emitting Diode Chip Having Distributed Bragg Reflector and Method of Fabricating the Same,” to Lee *et al.* Seoul Viosys is the owner by assignment of the ’157 Patent. A true and correct copy of the ’157 Patent is attached hereto as Exhibit 3.

15. On April 20, 2010, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 7,700,960 (“the ’960 Patent”), entitled “Light Emitting Diode With ITO Layer and Method for Fabricating the Same,” to Kim *et al.* Seoul Viosys is the owner

by assignment of the '960 Patent. A true and correct copy of the '960 Patent is attached hereto as Exhibit 4.

16. On May 1, 2012, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,168,988 (“the '988 Patent”), entitled “Light Emitting Element With a Plurality of Cells Bonded, Method of Manufacturing the Same, and Light Emitting Device Using the Same,” to Lee *et al.* Seoul Viosys is the owner by assignment of the '988 Patent. A true and correct copy of the '988 Patent is attached hereto as Exhibit 5.

17. On October 14, 2014, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,860,331 (“the '331 Patent”), entitled “Light Emitting Device for AC Power Operating,” to Lee *et al.* Seoul Viosys is the owner by assignment of the '331 Patent. A true and correct copy of the '331 Patent is attached hereto as Exhibit 6.

18. On September 9, 2014, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,829,552 (“the '552 Patent”), entitled “Light Emitting Device,” to Seo *et al.* Seoul Semiconductor is the owner by assignment of the '552 Patent. A true and correct copy of the '552 Patent is attached hereto as Exhibit 7.

19. On May 6, 2014, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,716,946 (“the '946 Patent”), entitled “Light Emitting Device for AC Power Operation,” to Lee *et al.* Seoul Viosys is the owner by assignment of the '946 Patent. A true and correct copy of the '946 Patent is attached hereto as Exhibit 8.

20. On May 31, 2011, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 7,951,626 (“the '626 Patent”), entitled “Light Emitting Device and Method of Manufacturing the Same,” to Lee *et al.* Seoul Viosys is the owner by assignment of the '626 Patent. A true and correct copy of the '626 Patent is attached hereto as Exhibit 9.

21. On March 4, 2014, the United States Patent and Trademark Office duly and legally issued U.S. Patent No. 8,664,638 (“the '638 Patent”), entitled “Light-Emitting Diode Having an Interlayer With High Voltage Density and Method for Manufacturing the Same,” to

Yoo *et al.* Seoul Viosys is the owner by assignment of the '638 Patent. A true and correct copy of the '638 Patent is attached hereto as Exhibit 10.

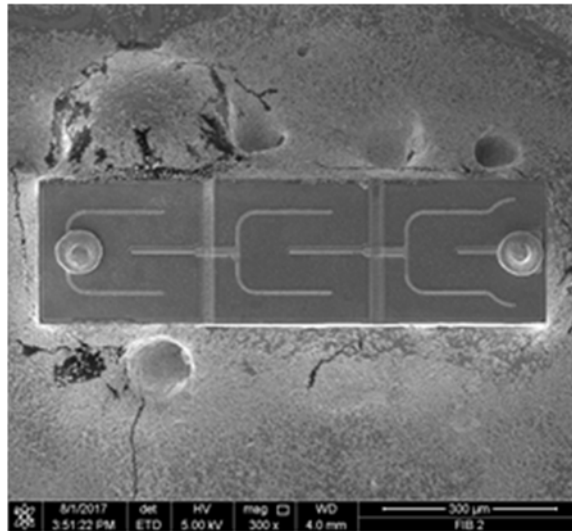
## **COUNT I**

### **INFRINGEMENT OF THE '435 PATENT**

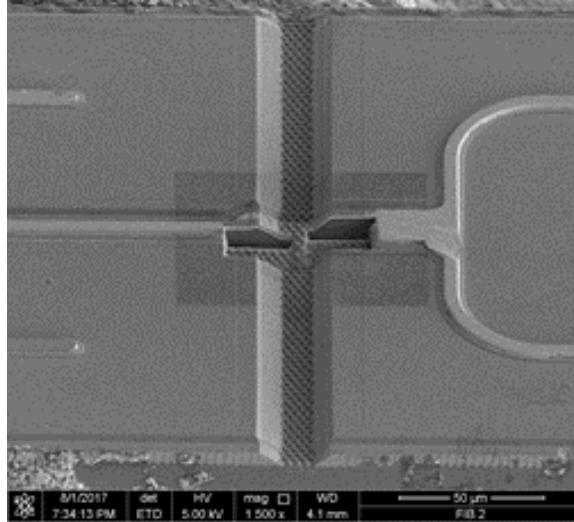
#### **EXAMPLE CLAIM 1**

22. 1000bulbs has infringed and continues to infringe one or more claims of the '435 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the A19F6027-2 bulb within the United States or importing the A19F6027-2 bulb into the United States.

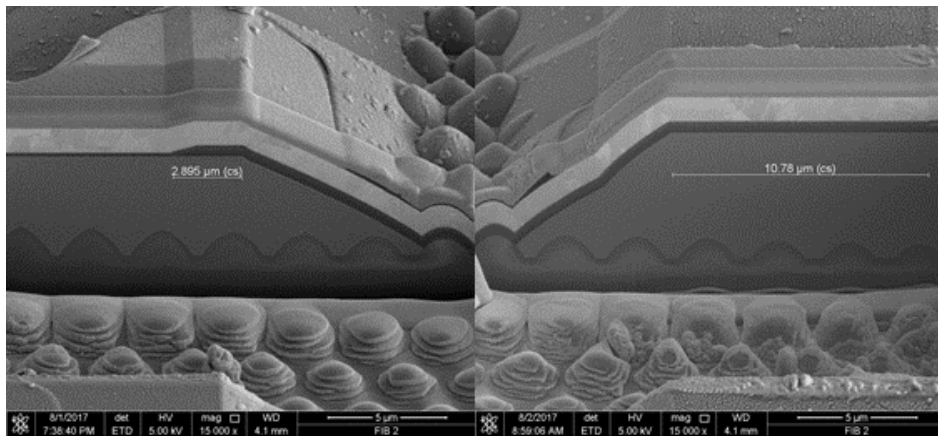
23. The A19F6027-2 bulb includes a plurality of LED packages, each of which includes a light emitting diode chip that comprises light emitting cells. A scanning electron microscope image of a chip from an A19F6027-2 bulb is reproduced below.



24. Below is a scanning electron microscope image of a pair of holes milled into the LED chip using a focused ion beam.



25. Below is a composite image created from scanning electron microscope images of the milled holes.



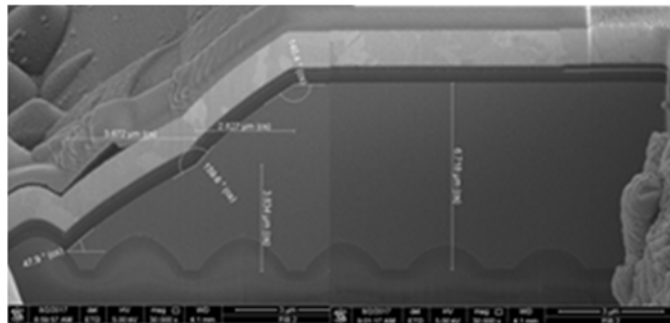
26. The bottom of the image reproduced above shows a substrate. Above the substrate are cross sectional views of portions of two light emitting cells.

27. Both of the light emitting cells include first and second semiconductor layers with an active layer disposed between them. The upper semiconductor layer comprises a p-type layer and the lower semiconductor layer comprises an n-type layer.

28. In addition, the light emitting cell on the right side of the image includes a continuous inclined surface having a slope between 20° and 80° from a horizontal plane of the substrate.

29. The light emitting cell on the right includes at least two conductive materials, including a metallic conductor and a transparent layer of indium tin oxide (ITO). At least one of those conductive materials is disposed on the upper p-type semiconductor layer of the cell on the right. And at least the other of those conductive materials electrically connects the light emitting cells.

30. Below is a composite image created from scanning electron microscope images of the milled hole in the light emitting cell on the right side of the image above. In this image, the ITO layer is shown as a relatively thin and bright line above the upper p-type semiconductor layer. The ITO layer extends horizontally from the right edge of the image. In this image, the metallic conductor is shown as including a relatively thick and bright layer above the upper p-type semiconductor that extends from the right side of the image to the left side of the image.



31. The cell on the right in the cross-sectional image above also includes at least two insulation layers. For example, portions of a pair of light-transmitting silicon dioxide ( $\text{SiO}_2$ ) layers are shown as relatively dark layers in the cross-sectional image. At least one of the  $\text{SiO}_2$  layers overlaps one of the conductive materials and both light emitting cells. And at least the other of the  $\text{SiO}_2$  layers overlaps the other of the conductive materials.

32. 1000bulbs' infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

33. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

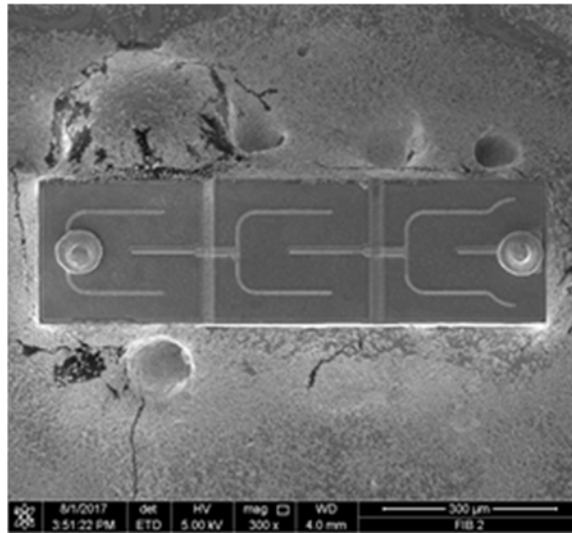
## **COUNT II**

### **INFRINGEMENT OF THE '627 PATENT**

#### **EXAMPLE CLAIM 1**

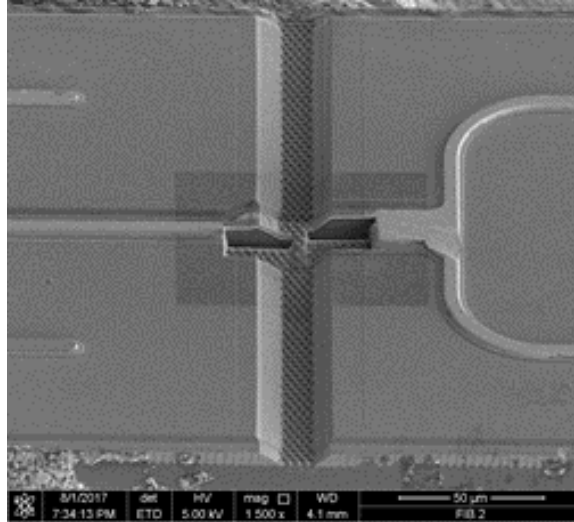
34. 1000bulbs has infringed and continues to infringe one or more claims of the '627 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the A19F6027-2 bulb within the United States or importing the A19F6027-2 bulb into the United States.

35. The A19F6027-2 bulb includes a plurality of LED packages, each of which includes a light emitting diode chip that comprises light emitting cells. A scanning electron microscope image of a chip from an A19F6027-2 bulb is reproduced below.

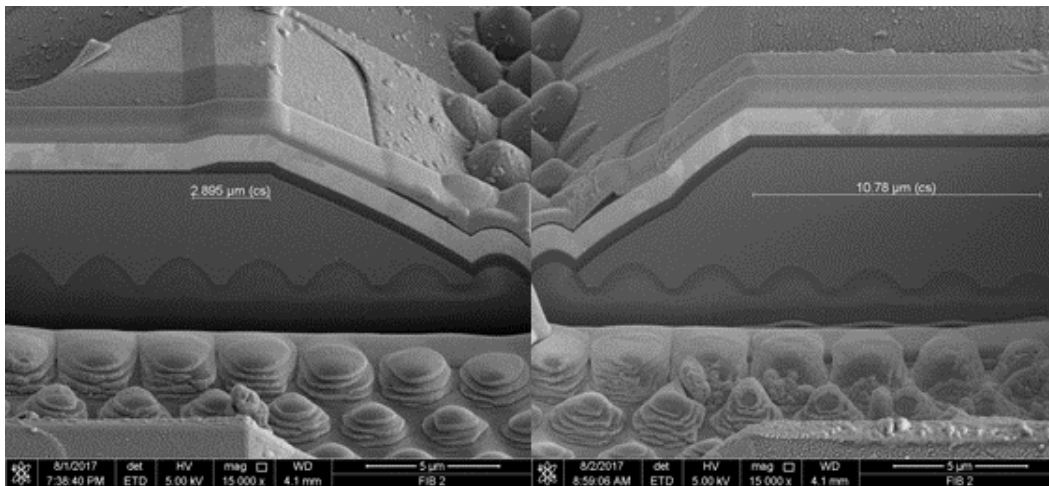


36. Below is a scanning electron microscope image taken after a pair of holes were milled into the LED chip using a focused ion beam.





37. Below is a composite image created from scanning electron microscope images of the milled holes.



38. The bottom of the image reproduced above shows a substrate. Above the substrate are cross sectional views of portions of two light emitting cells. The two light emitting cells are spaced apart from each other.

39. Disposed on the light emitting cell on the right side of the above image is an electrode comprised of ITO that provides an electrical connection to the underlying light emitting cell.

40. Below is a composite image created from scanning electron microscope images of the milled hole in the light emitting cell on the right side of the image above. In this image, the



46. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

### **COUNT III**

#### **INFRINGEMENT OF THE '157 PATENT**

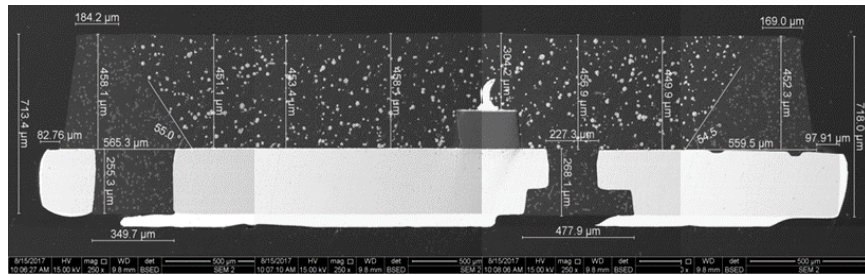
##### **EXAMPLE CLAIM 1**

47. 1000bulbs has infringed and continues to infringe one or more claims of the '157 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the A19F6027-2 bulb within the United States or importing the A19F6027-2 bulb into the United States.

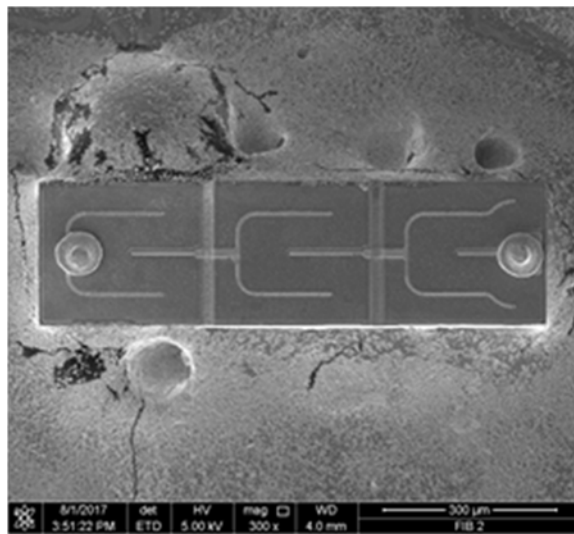
48. The A19F6027-2 bulb includes a plurality of LED packages, each of which includes a light emitting diode chip that comprises light emitting cells. An optical microscope image of a portion of the top of a package from an A19F6027-2 bulb is reproduced below.



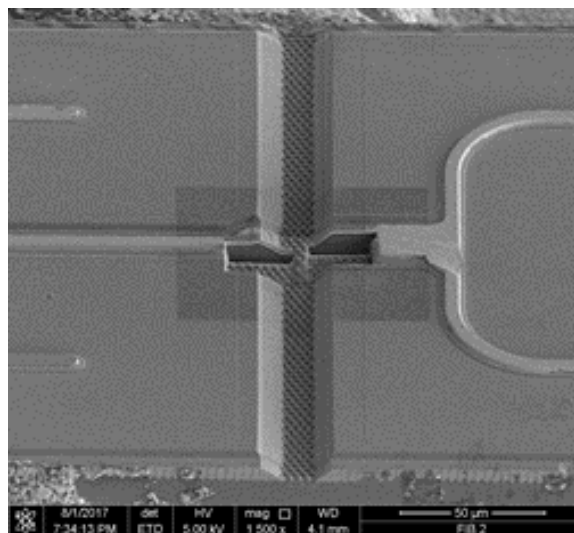
49. A scanning electron microscope image of a cross-section through the package is reproduced below. The cross-sectional view shows the body, leads, and a mounting surface upon which a light emitting diode chip is disposed. The light emitting diode chip is shown covered by a member comprised of resin. The resin member contains phosphor particles, which can be seen as relatively bright particles within the darker resin.



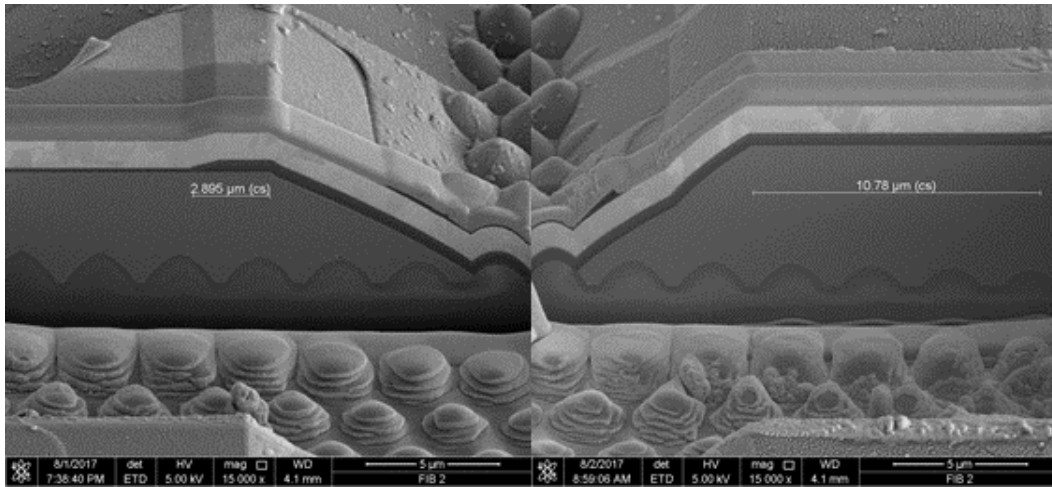
50. A scanning electron microscope image of a light emitting diode chip from an A19F6027-2 bulb is reproduced below.



51. Below is a scanning electron microscope image taken after a pair of holes were milled into the LED chip using a focused ion beam.

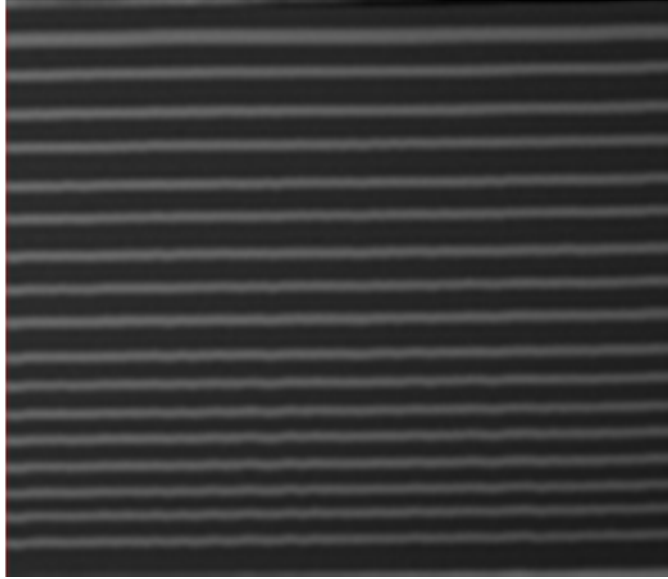


52. Below is a composite image created from scanning electron microscope images of the milled holes.



53. The composite image above shows portions of two light emitting cells above a substrate, one toward the left side of the image and one toward the right side of the image. The portion of the light emitting cell toward the right side of the image above includes an active layer disposed between an upper p-type semiconductor layer and a lower n-type semiconductor layer.

54. The image below shows a portion of the distributed Bragg reflector located on the bottom of the substrate on which the light emitting cells are located. As shown in the below image, the distributed Bragg reflector comprises two portions, an upper portion comprising relatively thick layers of SiO<sub>2</sub> and titanium dioxide (TiO<sub>2</sub>) and a lower portion comprising relatively thin layers of SiO<sub>2</sub> and TiO<sub>2</sub>. The relatively dark layers comprise SiO<sub>2</sub> and the relatively bright comprise TiO<sub>2</sub>. The optical thickness of the layers comprising the upper portion are nearly 1.5 times the optical thickness of the layers comprising the lower portion.



55. 1000bulbs' infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

56. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

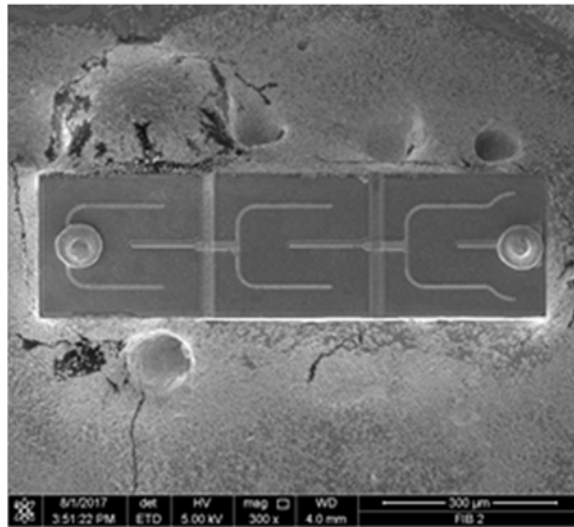
#### **COUNT IV**

#### **INFRINGEMENT OF THE '960 PATENT**

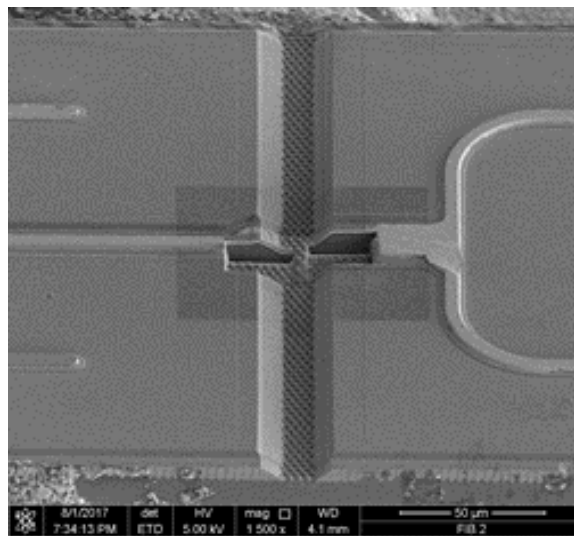
#### **EXAMPLE CLAIM 1**

57. 1000bulbs has infringed and continues to infringe one or more claims of the '960 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a) at least by without authority making, using, offering to sell, and/or selling the A19F6027-2 bulb within the United States or importing the A19F6027-2 bulb into the United States.

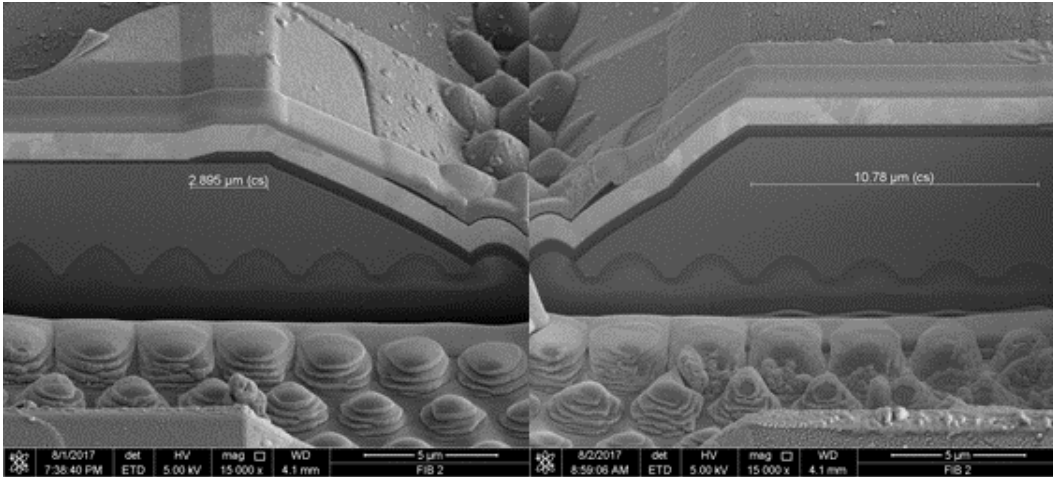
58. The A19F6027-2 bulb includes a plurality of LED packages, each of which includes a light emitting diode chip that comprises light emitting cells. A scanning electron microscope image of a chip from an A19F6027-2 bulb is reproduced below.



59. Below is a scanning electron microscope image taken after a pair of holes were milled into the LED chip using a focused ion beam.



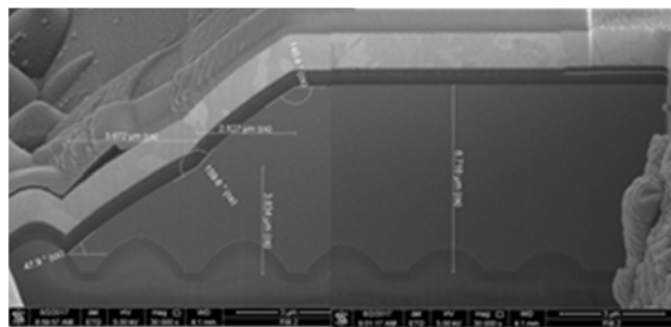
60. Below is a composite image created from scanning electron microscope images of the milled holes.



61. The composite image above shows portions of two example light emitting cells above a substrate, one toward the left side of the image and one toward the right side of the image. Both light emitting cells include at least two semiconductor layers and inclined surfaces.

62. A current diffusion layer, which is comprised of ITO, is arranged on the upper semiconductor layer of the light emitting cell on the right side of the above image.

63. Below is a composite image created from scanning electron microscope images of the milled hole in the light emitting cell on the right side of the image above. In this image and the image above, the ITO layer is shown as a relatively thin bright line extending horizontally from the right edge of the image. As the image shows, the ITO layer extends over only a portion of the upper surface of the light emitting cell, leaving an opening.



64. An insulation layer, which is comprised of  $\text{SiO}_2$ , is arranged under a portion of the ITO current diffusion layer. This arrangement can be seen in the above images, where the  $\text{SiO}_2$  is



a relatively thick and dark layer that extends from the right edge of the images to the top surface of the light emitting cell on the left.

65. A conductive material, which is comprised of layers of metals, is arranged on the insulation layer described in the preceding paragraph. The conductive material couples the two light emitting cells. The conductive material is also coupled to the upper p-type semiconductor layer in each cell through the ITO current diffusion layer. The conductive material is shown in the images above as including a relatively thick and bright layer that extends from the left to right edges of both images above.

66. A second insulation layer, which is also comprised of SiO<sub>2</sub>, is arranged over a portion of the conductive material. The second insulation layer is shown as a relatively thin and dark layer above the conductive material in the images above.

67. As shown in the composite image of the milled hole in the light emitting cell the right of the above image, a portion of the conductive material toward the right side of the image overlaps with the ITO current diffusion layer and a portion of the conductive material extends toward the center beyond the ITO current diffusion layer. The portion that extends beyond the ITO current diffusion layer is arranged in the opening in that layer.

68. 1000bulbs' infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

69. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

## **COUNT V**

### **INFRINGEMENT OF THE '988 PATENT**

#### **EXAMPLE CLAIM 1**

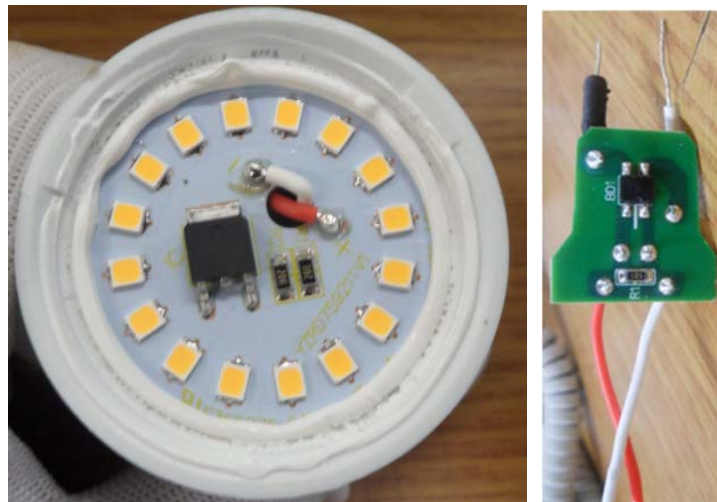
70. 1000bulbs has infringed and continues to infringe one or more claims of the '988 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a) at least by

without authority making, using, offering to sell, and/or selling the A19F6027-2 bulb within the United States or importing the A19F6027-2 bulb into the United States.

71. The A19F6027-2 bulb is a light emitting device that includes a power source formed, in part, by the E26 size standard screw-in base by which power is provided to the active portions of the bulb, which is depicted below.



72. The images below show two circuit boards from the A19F6027-2 bulb.



73. The circuit board in the left image above includes a light emitting element comprising a plurality of series connected light emitting cells.

74. Elements of a control unit configured to control a voltage waveform and a current waveform applied to the light emitting element are provided on the circuit boards shown above. Among the circuit elements are a resistor mounted on the circuit board shown in the right image above, which is connected in parallel with the light emitting cells.

75. The element labeled BD1 in the right image above is a rectifying bridge unit comprising four diodes, which comprises part of the light emitting element. The rectifying bridge unit is connected to the power source unit.

76. 1000bulbs' infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

77. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

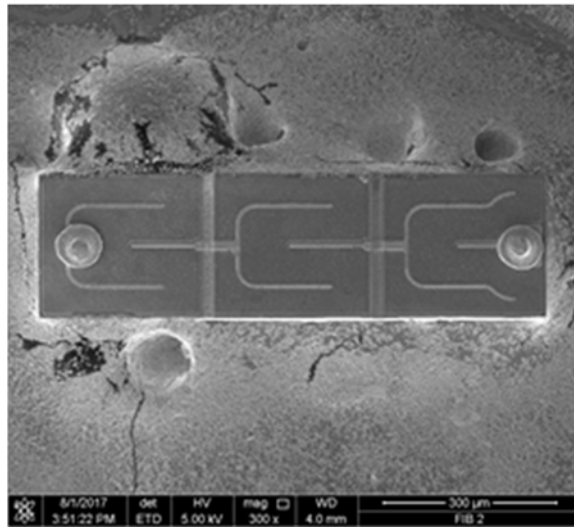
## **COUNT VI**

### **INFRINGEMENT OF THE '331 PATENT**

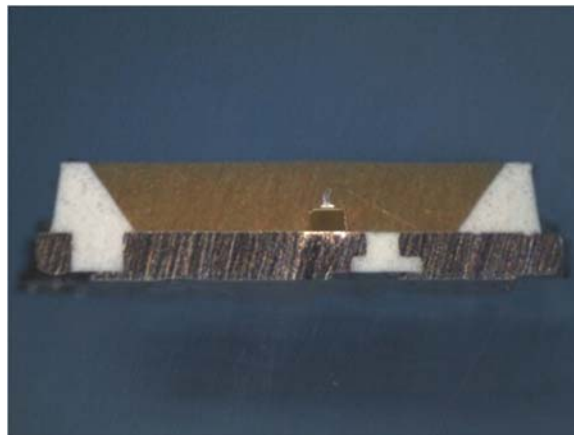
#### **EXAMPLE CLAIM 11**

78. 1000bulbs has infringed and continues to infringe one or more claims of the '331 Patent, including but not limited to claim 11, pursuant to 35 U.S.C. § 271(a) at least by without authority making, using, offering to sell, and/or selling the A19F6027-2 bulb within the United States or importing the A19F6027-2 bulb into the United States.

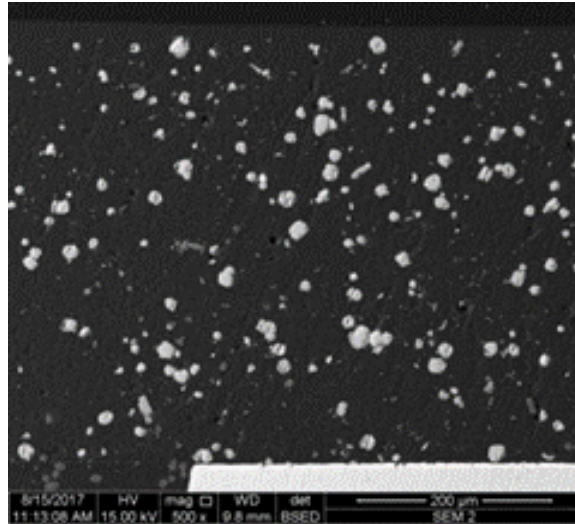
79. The A19F6027-2 bulb includes a plurality of LED packages, each of which includes an LED chip that comprises a plurality of light emitting cells connected in series. A scanning electron microscope image of an LED chip from an A19F6027-2 bulb is reproduced below.



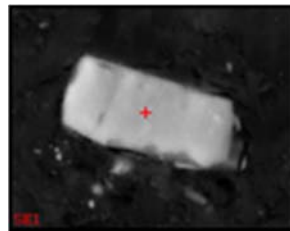
80. Below is an optical microscope image of a cross section through an example LED package from a A19F6027-2 bulb. The optical image shows a transparent member made of resin covering the LED chip.



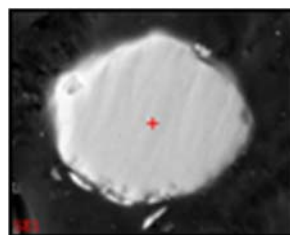
81. Below is a scanning electron microscope image of a portion of the transparent member from a A19F6027-2 bulb. The image shows two different types of phosphors.



82. An example particle of a first phosphor, which generally have a relatively elongated shape and possess a relatively long decay time when excited by the LED chip, is depicted below.



83. An example particle of a second phosphor, which generally have a relatively circular shape and possess a relatively short decay time when excited by the LED chip, is depicted below.



84. Both types of phosphor emit light within the visible range when excited by light from the LED chip.

85. 1000bulbs' infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

86. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

### **COUNT VII**

### **INFRINGEMENT OF THE '552 PATENT**

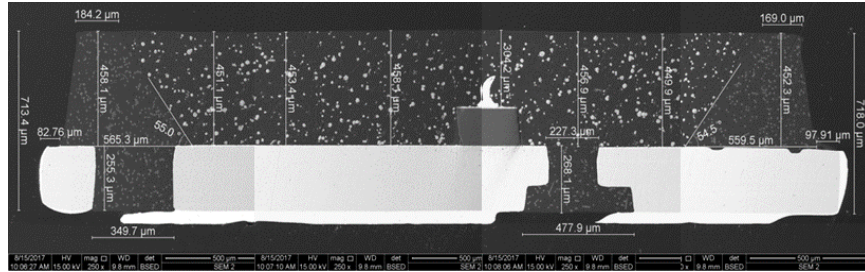
#### **EXAMPLE CLAIM**

87. 1000bulbs has infringed and continues to infringe one or more claims of the '552 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a) at least by without authority making, using, offering to sell, and/or selling the A19F6027-2 bulb within the United States or importing the A19F6027-2 bulb into the United States.

88. The A19F6027-2 bulb includes a plurality of LED packages, each of which comprises a light emitting diode device. An optical microscope image of a portion of the top of a package from an A19F6027-2 bulb is reproduced below.

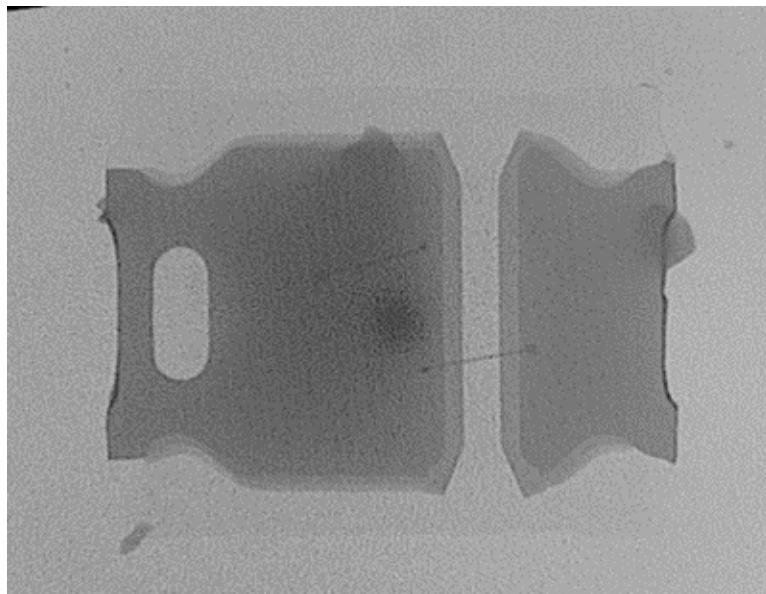


89. A scanning electron microscope image of a cross-section through the package is reproduced below.



90. The image above depicts the cross-section of a pair of spaced-apart lead frames, which indicates the upper and lower surfaces of each lead frame. Each of the lead frames also includes sidewalls that connect the upper and lower surfaces.

91. An x-ray image taken vertically through the pair of lead frames is reproduced below. The darkest area on the left lead frame in the image below indicates a light emitting diode chip, which can also be seen near the center in the cross-sectional image above. The x-ray image below also depicts for each lead frame a central relatively dark area that encompasses the majority of each lead frame. The x-ray image also depicts, for each lead frame, three relatively bright zones at the periphery. The relatively bright areas correspond to the locations with insets in the sidewalls, which can also be seen in the cross-sectional image above right as small areas under each lead frame that are filled with resin.



92. The three inset sidewalls described in the preceding paragraph at least partially define a fixing space for each of the lead frames that undercuts the upper surface. The fixing spaces are filled with resin as shown in the image above to support the two lead frames.

93. 1000bulbs' infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

94. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

### **COUNT VIII**

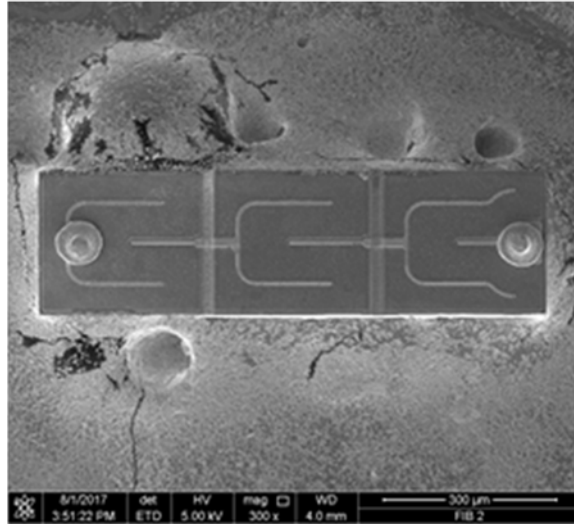
#### **INFRINGEMENT OF THE '946 PATENT**

##### **EXAMPLE CLAIM 1**

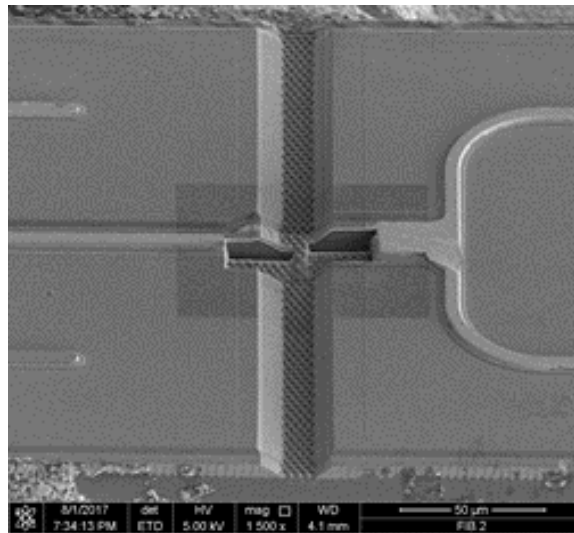
95. 1000bulbs has infringed and continues to infringe one or more claims of the '946 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a) at least by without authority making, using, offering to sell, and/or selling the A19F6027-2 bulb within the United States or importing the A19F6027-2 bulb into the United States.

96. The A19F6027-2 bulb includes a plurality of LED packages, each of which includes a light emitting diode chip that comprises a series connected array of light emitting cells. The array is configured to receive an input voltage to cause the cells to emit light. A scanning electron microscope image of a chip from an A19F6027-2 bulb is reproduced below.

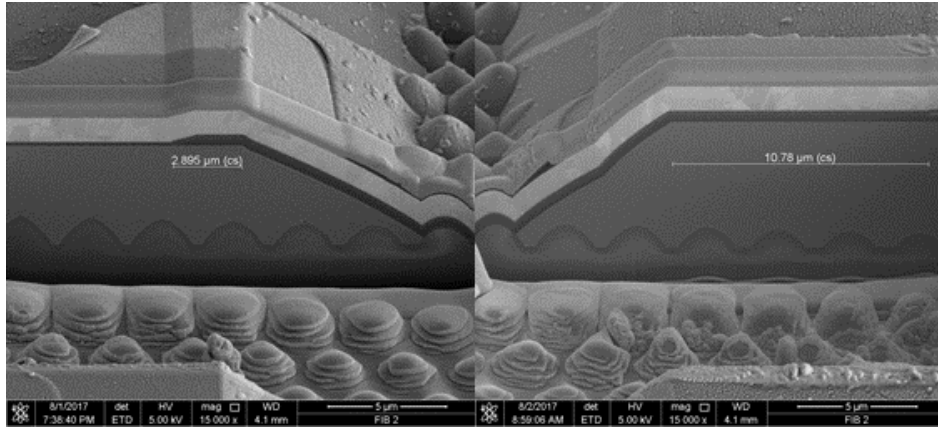




97. Below is a scanning electron microscope image of a pair of holes milled into the LED chip using a focused ion beam.

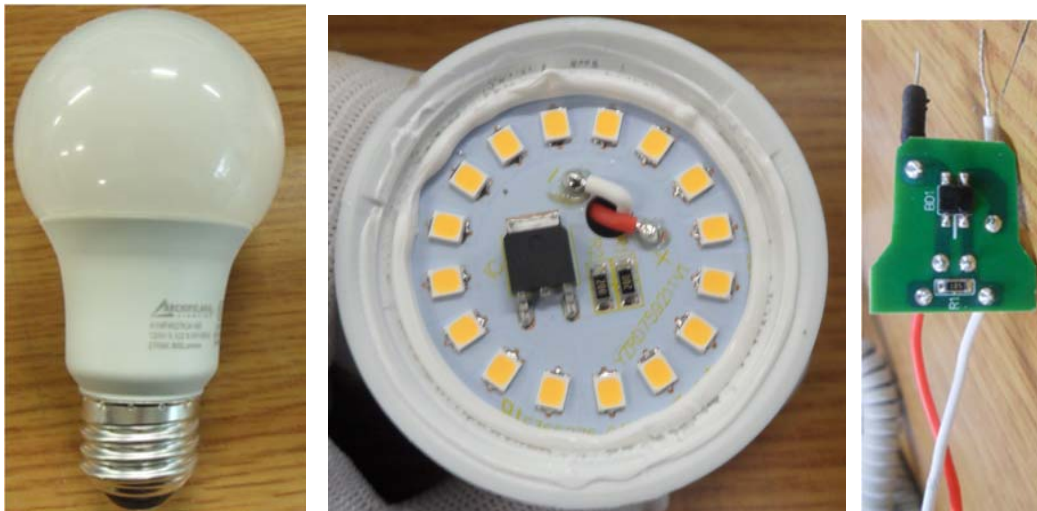


98. Below is a composite image created from scanning electron microscope images of the milled holes.



99. The bottom of the image reproduced above shows a substrate. Above the substrate are cross sectional views of portions of two of the light emitting cells, each of which includes an inclined side surface.

100. Three images are provided below. From left to right, those images are: the full A19F6027-2 bulb; a first circuit board contained within the bulb; and a second circuit board contained within the bulb.



101. Two different voltages are relevant to the operation of the A19F6027-2 bulb.

102. As indicated by the E26 base of the bulb as depicted in the image to the left above, the A19F6027-2 bulb receives as input a wall voltage of 120V and 60Hz alternating current electricity. The reference to 60Hz indicates the periodic cycles over which the input

voltage changes. During each cycle, the wall voltage includes a peak of approximately 120 volts after which the voltage falls toward zero volts.

103. Although wall voltage is received as the input to the A19F6027-2 bulb, the light emitting cells cannot be properly driven by the 120V/60Hz alternating current. The 120V/60Hz alternating current has a cyclical peak of approximately 120 volts in the forward direction, passes through zero, and then reaches a peak of approximately 120 volts in the reverse direction. The alternating current, therefore, drops below the level necessary to drive the light emitting cells after the peak of 120 volts.

104. Instead of applying the input voltage to the light emitting cells, elements on the circuit boards above center and right convert the input to DC-like power to drive the light emitting cells. The DC-like power has a cyclical voltage that varies between approximately 149 volts and 138 volts. The cyclical DC-like power causes the light emitting cells to emit light having a periodically changing luminous intensity that remains non-zero throughout the cycle of the input 120V/60Hz alternating current.

105. 1000bulbs' infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

106. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

### **COUNT IX**

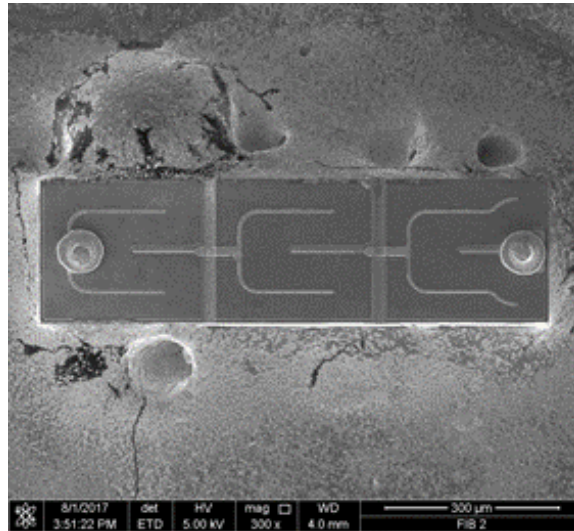
#### **INFRINGEMENT OF THE '626 PATENT**

##### **EXAMPLE CLAIM 9**

107. On information and belief, 1000bulbs has infringed and continues to infringe at least exemplary claim 9 of the '626 Patent pursuant to 35 U.S.C. § 271(g) at least by without authority importing into the United States or offering to sell, selling, and/or using within the United States A19F6027-2 bulbs, which on information and belief are made by a process that

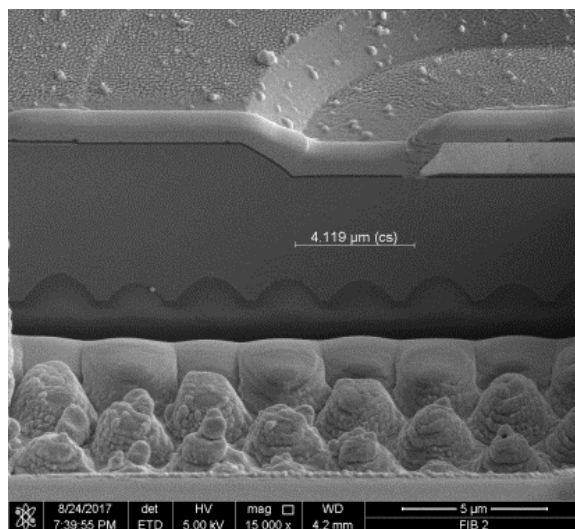
infringes those claims and are not materially changed by subsequent processes and do not become a trivial and nonessential component of another product.

108. Below is a scanning electron microscope image of the top surface of an LED from the A19F6027-2 bulb.



109. The n-pad of the LED is shown as a circular structure toward the center of the right side of the image. The N-pad is formed over an n-type semiconductor layer. The p-pad of the LED is shown as a circular structure toward the center of the left side of the image. The P-pad is formed over a p-type semiconductor layer.

110. As shown in another scanning electron microscope image, which was created after milling a hole in the LED chip, a mesa having a sloped edge exists at the surface of the LED chip. The mesa, which appears at the left side of the image, comprises a layer of P-type material toward the top, an active layer under the P-type layer, and a layer of N-type material under the active layer.



111. In view of the angular slope of the mesa edge, and upon information and belief regarding the process used to manufacture the LED chip, the mesa edge shape was created by forming an etching pattern on the surface, hard-baking the photoresist to create an inclined edge, and etching the photoresist and portions of the surface.

112. 1000bulbs' infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

113. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

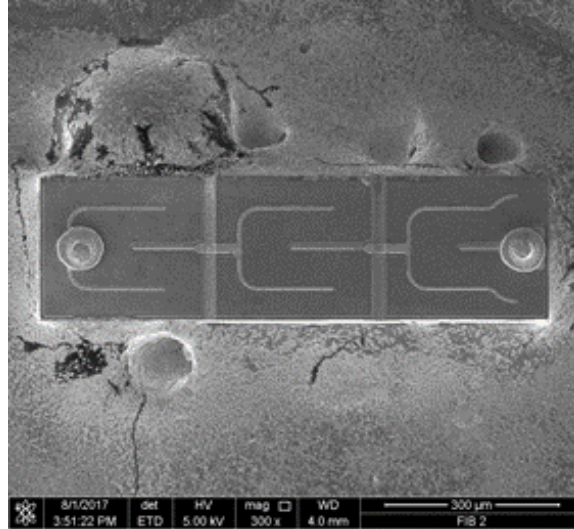
## **COUNT X**

### **INFRINGEMENT OF THE '638 PATENT**

#### **EXAMPLE CLAIM 1**

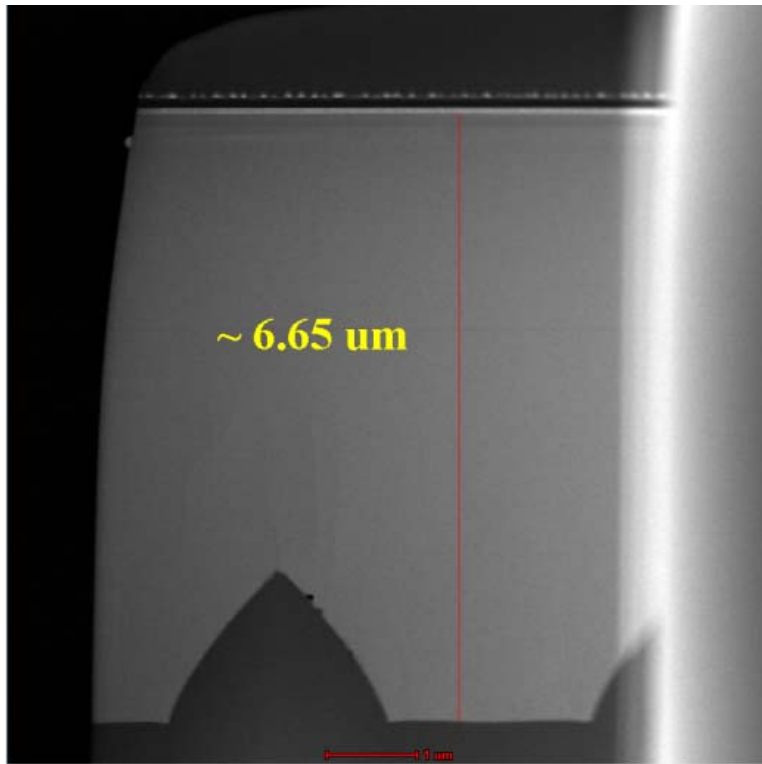
114. 1000bulbs has infringed and continues to infringe one or more claims of the '638 Patent, including but not limited to exemplary claim 1, pursuant to 35 U.S.C. § 271(a), at least by without authority making, using, offering to sell, and/or selling the A19F6027-2 bulb within the United States or importing the A19F6027-2 bulb into the United States.

115. The A19F6027-2 bulb includes a plurality of LED packages, each of which includes a light emitting diode. A scanning electron microscope image of a chip from an A19F6027-2 bulb is reproduced below.



116. The above image depicts two pads. The left side of the chip includes a p-pad, which is electrically connected to a p-type contact layer. The right side of the chip includes a n-pad, which is electrically connected to an n-type contact layer.

117. A tunneling electron microscope image depicting the cross section of the epitaxial layers of the chip from the A19F6027-2 bulb is reproduced below.



118. The chip from the A19F6027-2 bulb includes a plurality of different semiconductor layers formed over a substrate. Among the layers included are, from bottom to top, a buffer layer, a gallium nitride-based first lower semiconductor layer, a gallium nitride-based first interlayer that comprises a single composition, a gallium nitride-based second interlayer, a gallium nitride-based n-type contact layer, and active layer, and a gallium nitride-based p-type contact layer. The first interlayer comprises the same composition as the n-type contact layer.

119. Upon information and belief, the second interlayer has a higher dislocation density than the first lower semiconductor layer and the second interlayer has a dislocation density different from that of the first interlayer. Upon information and belief, the first interlayer has a lower dislocation density than the buffer layer, and has higher dislocation density than the first lower semiconductor layer.

120. 1000bulbs' infringement has caused and is continuing to cause damage and irreparable injury to Plaintiffs. Plaintiffs will continue to suffer damage and irreparable injury

unless and until that infringement is enjoined by this Court, as a remedy at law alone would be inadequate.

121. Plaintiffs are entitled to injunctive relief and damages in accordance with 35 U.S.C. §§ 271, 281, 283, and 284.

### **PRAYER FOR RELIEF**

WHEREFORE, Plaintiffs respectfully requests that this Court enter judgment in its favor and against 1000bulbs as follows:

A. A declaration that 1000bulbs has infringed the '435 Patent, '627 Patent, '157 Patent, '960 Patent, '988 Patent, '331 Patent, '552 Patent, '946 Patent, '626 Patent, and '638 Patent under 35 U.S.C. § 271, and a final judgment incorporating the same;

B. A permanent injunction, enjoining 1000bulbs and its officers, agents, servants, employees, representatives, successors, and assigns, and all others acting in concert or participation with them from continued infringement under 35 U.S.C. § 271 of the '435 Patent, '627 Patent, '157 Patent, '960 Patent, '988 Patent, '331 Patent, '552 Patent, '946 Patent, '626 Patent, and '638 Patent;

C. An award of damages adequate to compensate Plaintiffs for 1000bulbs' infringement the '435 Patent, '627 Patent, '157 Patent, '960 Patent, '988 Patent, '331 Patent, '552 Patent, '946 Patent, '626 Patent, and '638 Patent, together with prejudgment and post-judgment interest and costs pursuant to 35 U.S.C. § 284;

D. An accounting of all infringing sales and other infringing acts by 1000bulbs, and an order compelling an accounting for infringing acts not presented at trial and an award by the Court of additional damages for such acts; and

E. Any other relief to which Plaintiffs are entitled or that the Court seems just and proper.

### **JURY DEMAND**

Pursuant to Rule 38(b) of the Federal Rules of Civil Procedure, Plaintiffs hereby demand trial by jury of all issues so triable.



DATED: March 2, 2018

Respectfully submitted,

HOLLAND & KNIGHT LLP

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