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YU et al.

(54) **PACKAGE STRUCTURE**

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Related U.S. Application Data

(60) Division of application No. 17/723,536, filed on Apr. 19, 2022, which is a continuation-in-part of application No. 17/109,255, filed on Dec. 2, 2020, now abandoned.

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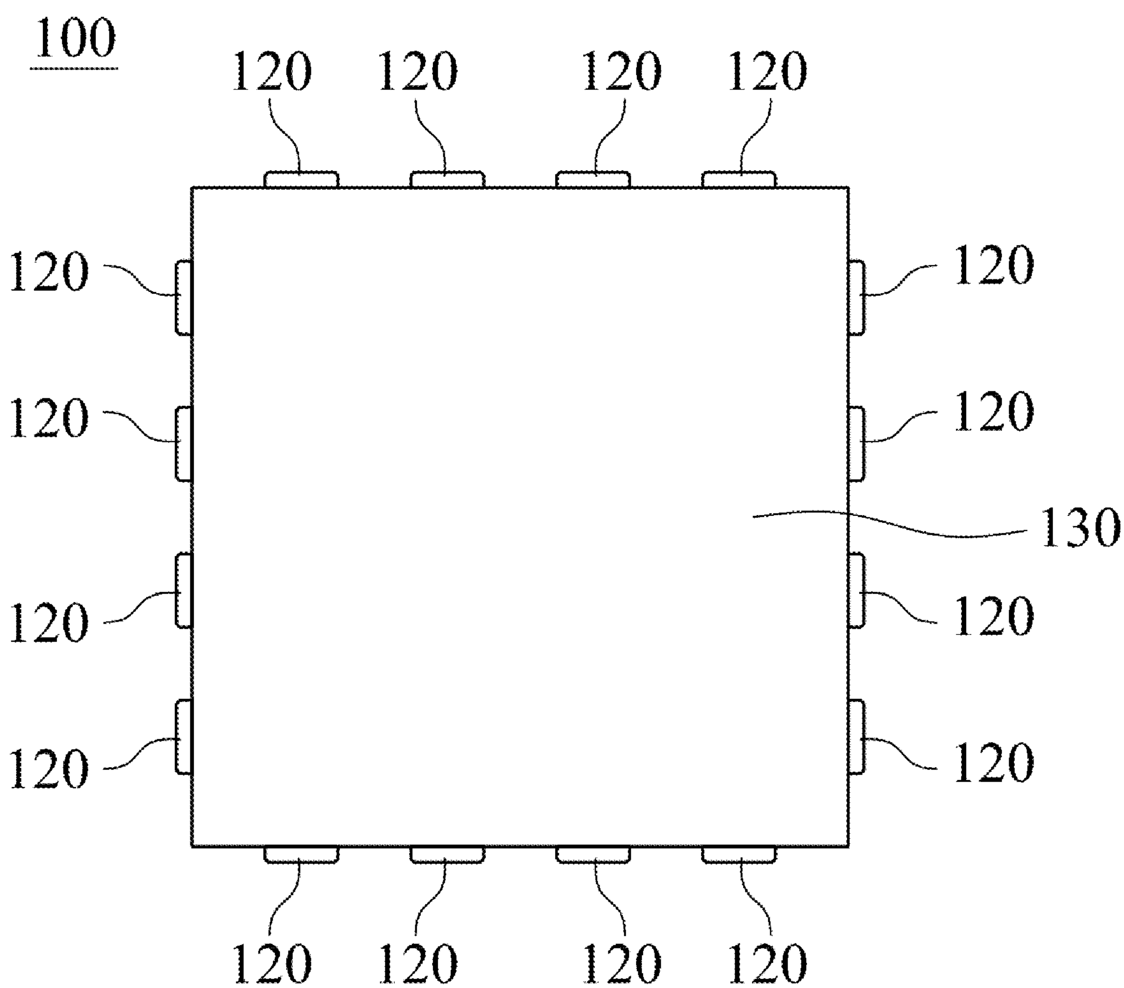
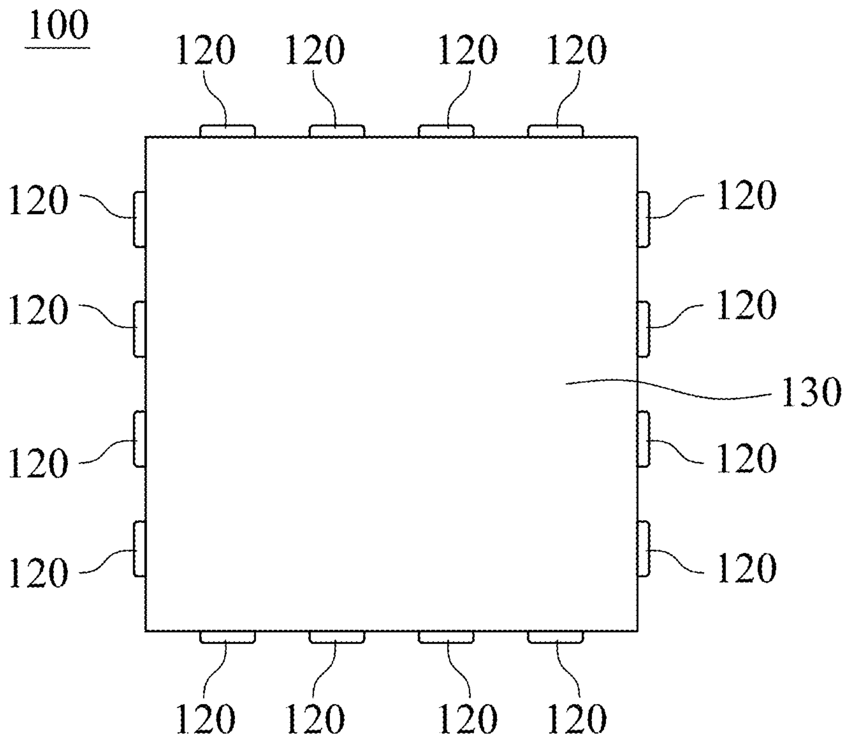
H01L 23/31 (2006.01)

(52) **U.S. Cl.**
CPC ***H01L 23/49503*** (2013.01); ***H01L 23/3107*** (2013.01); ***H01L 23/49582*** (2013.01)

(57) **ABSTRACT**

A package structure includes a leadframe, a semiconductor die and a plastic package material. The leadframe includes a die pad and a plurality of leads. The leads are disposed on four peripheral regions of the die pad, and each of the leads includes a main body, at least one extending portion and a plurality of plating surfaces. The extending portion is connected to the main body, and the main body and the extending portion are integrally formed. The plating surfaces are disposed on the main body and the extending portion. The semiconductor die is disposed on the die pad of the leadframe. The plastic package material is disposed on the leadframe. The main body and the extending portion of each of the leads protrude a peripheral region of the plastic package material.

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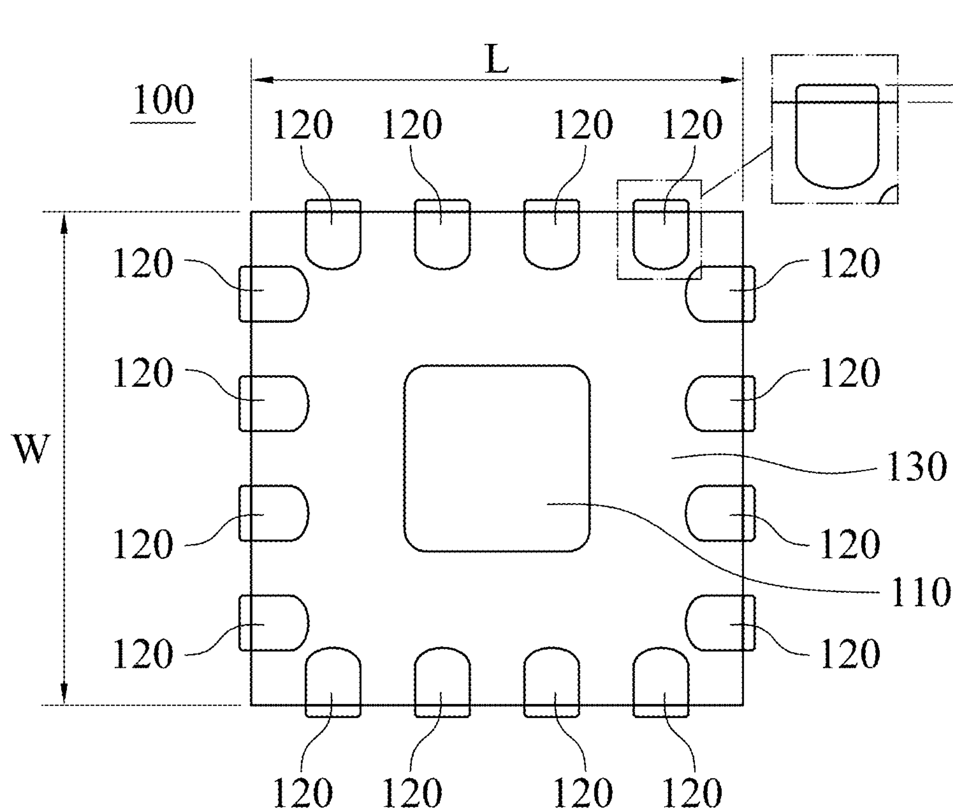
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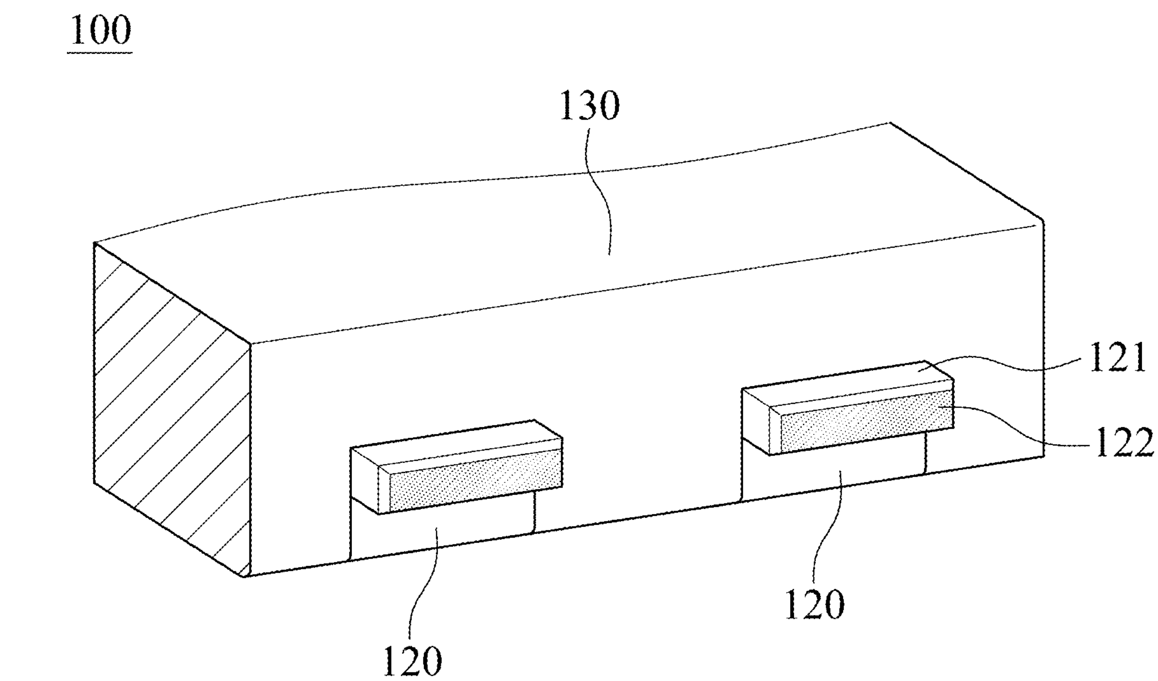
Fig. 2



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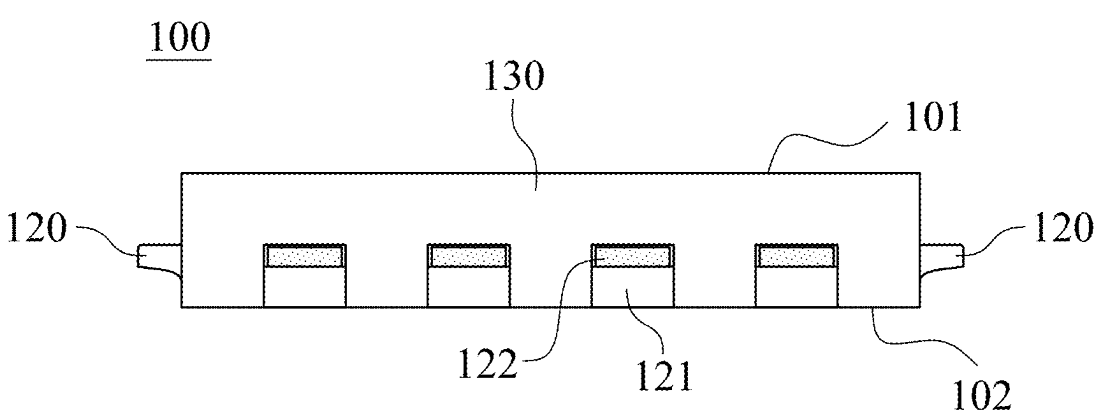

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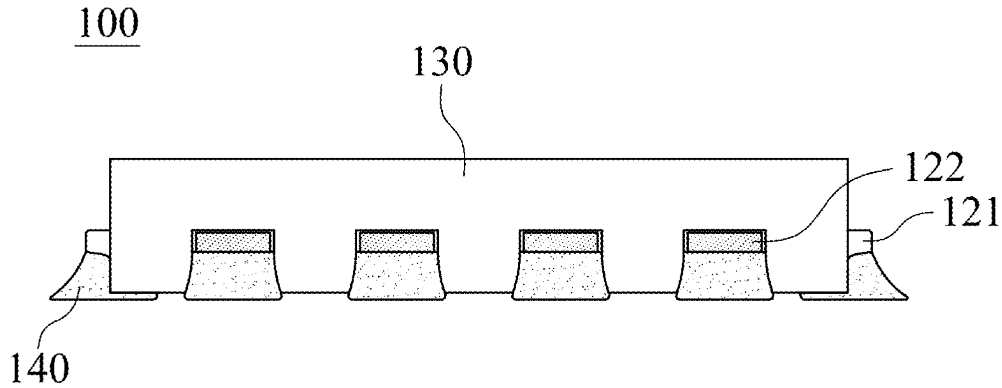

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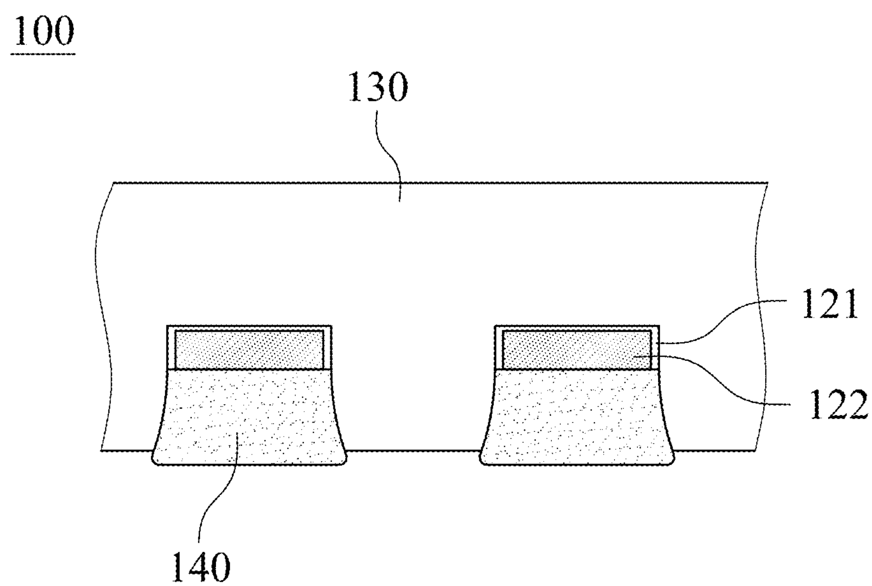

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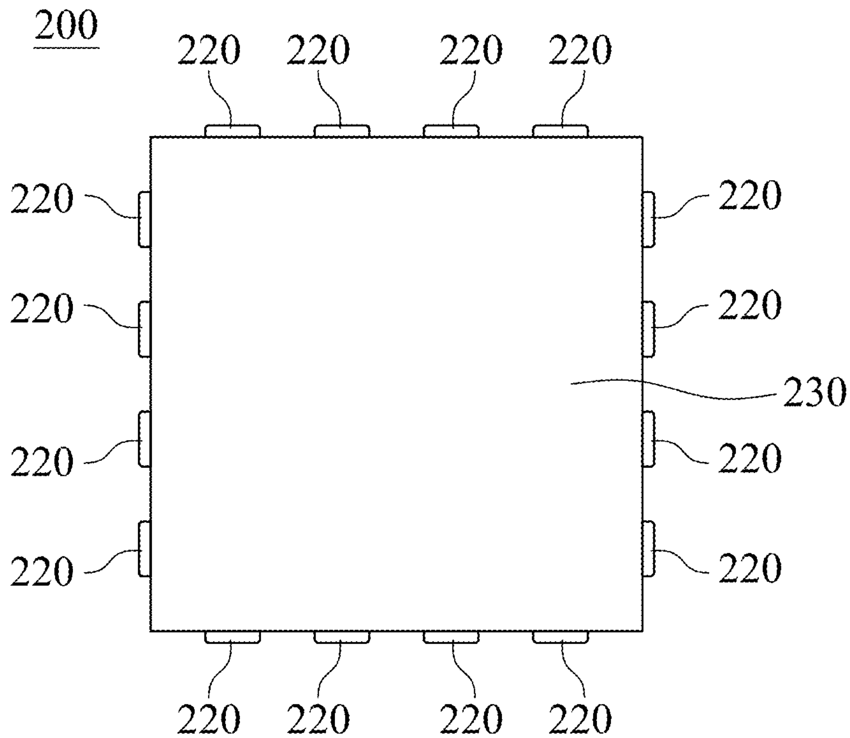
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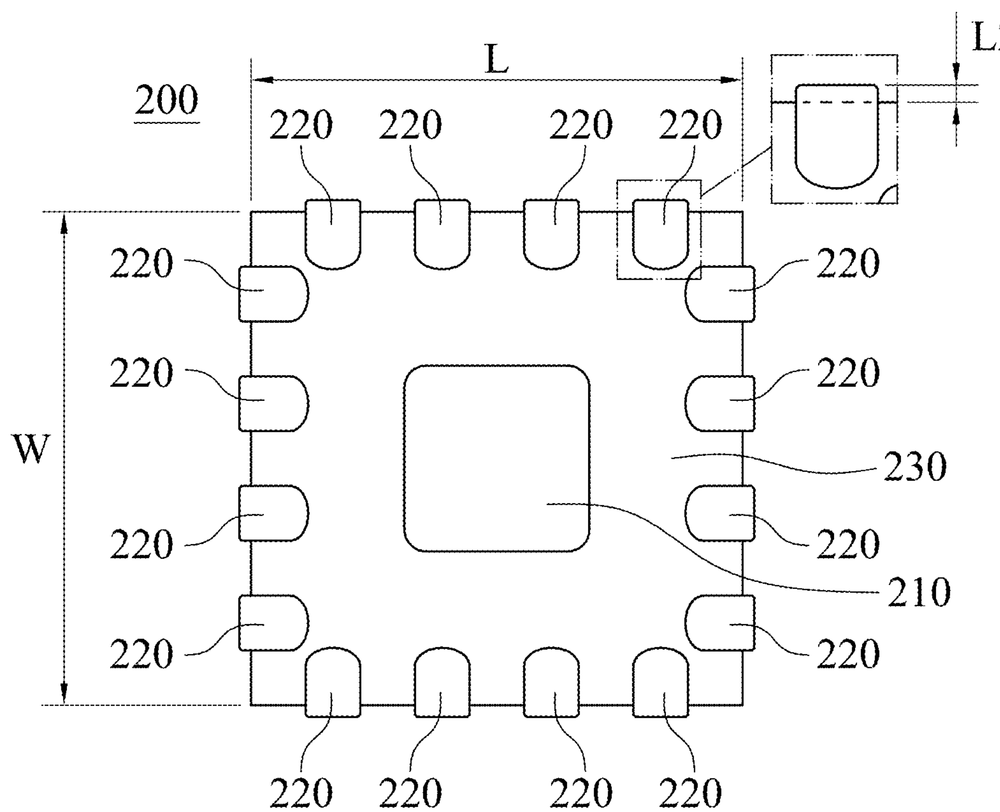
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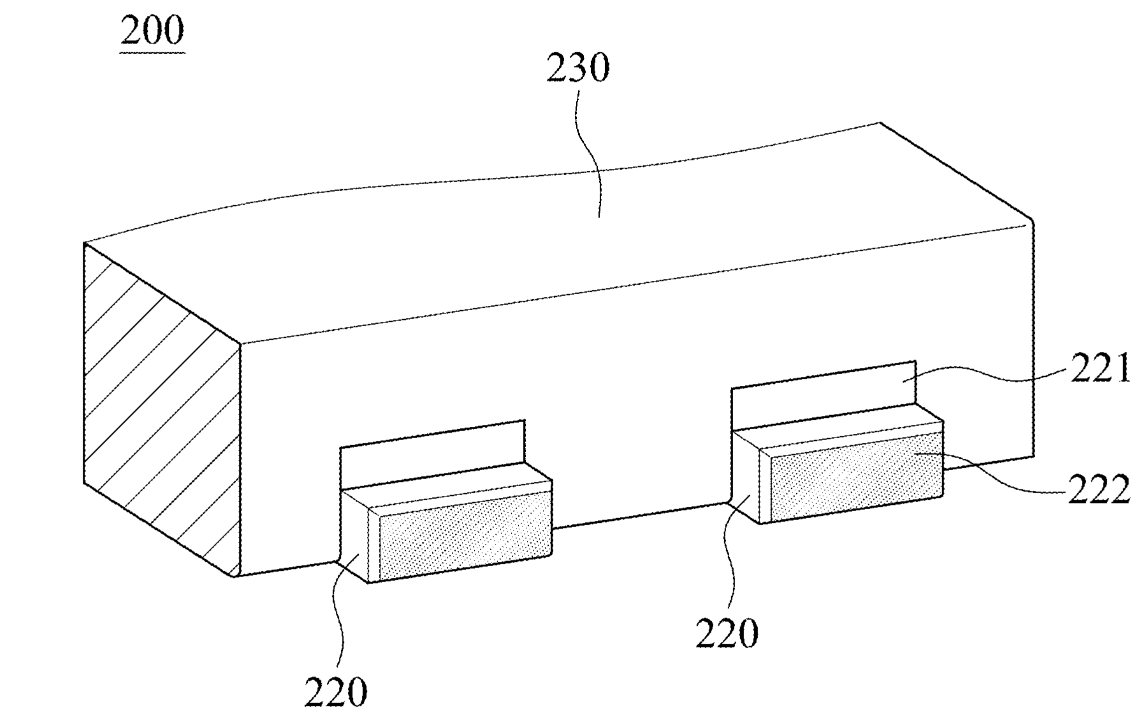
Fig. 8



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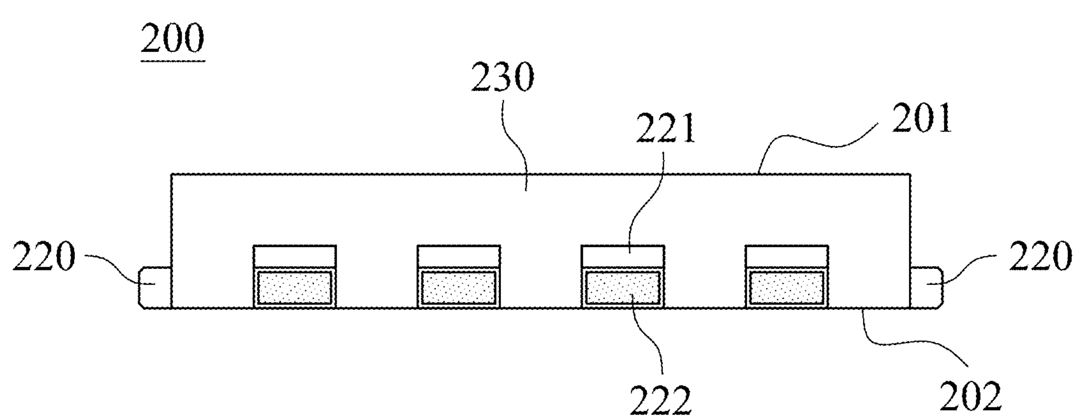

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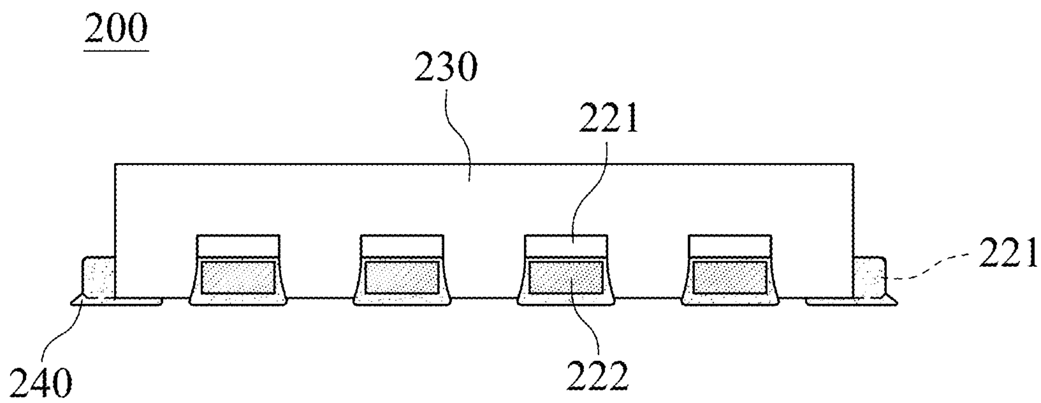

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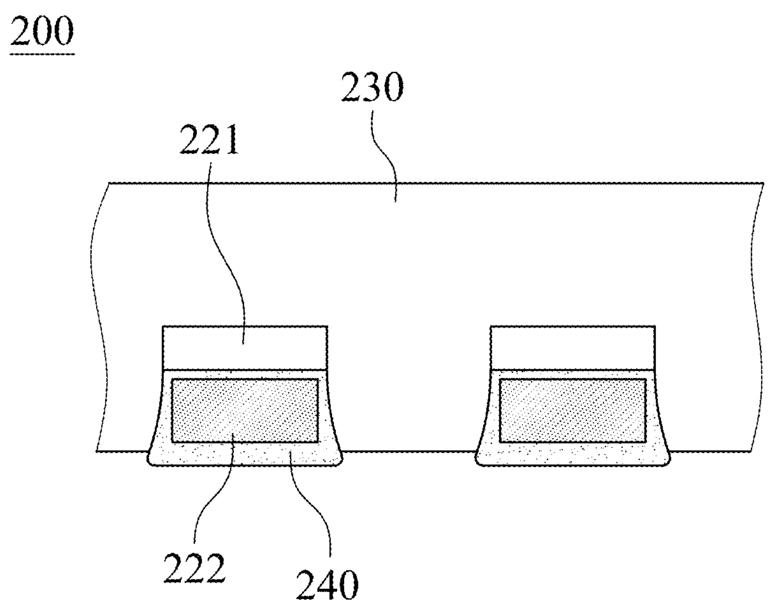

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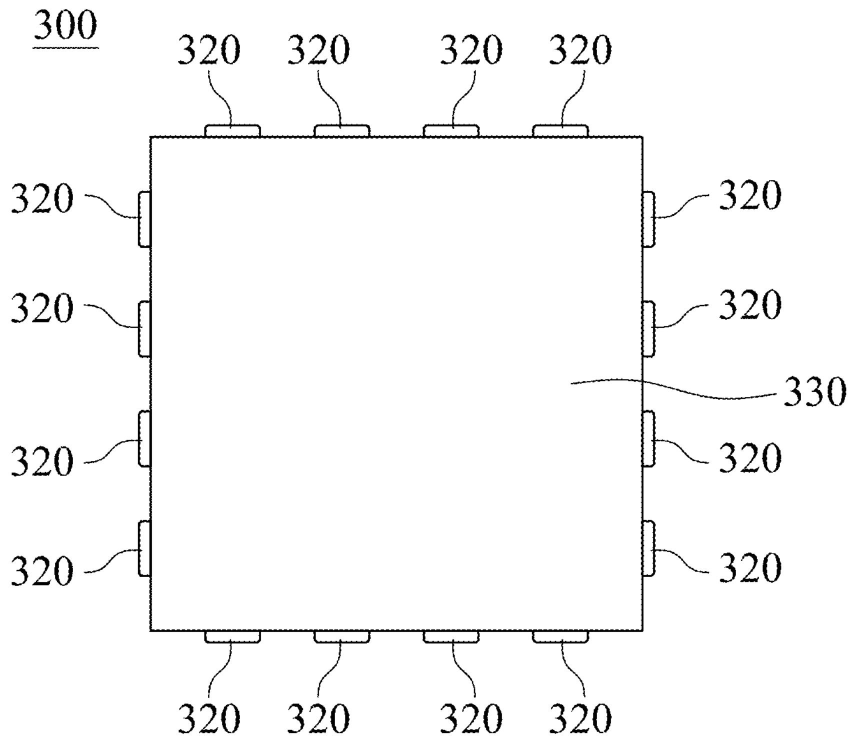
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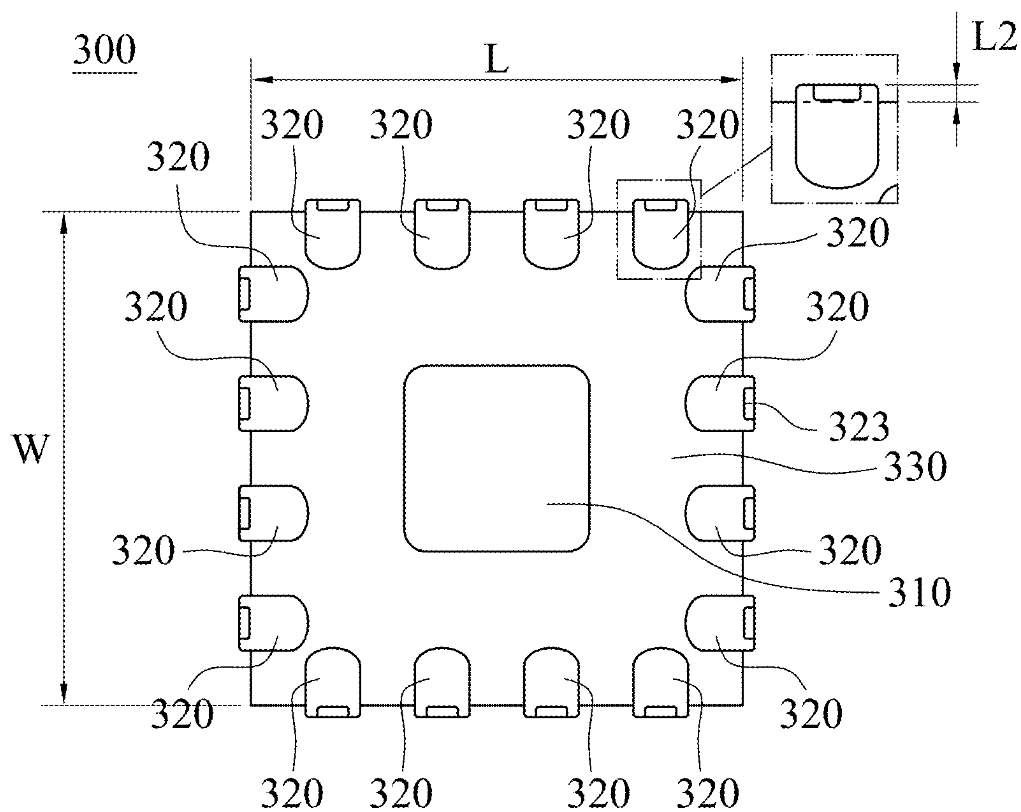
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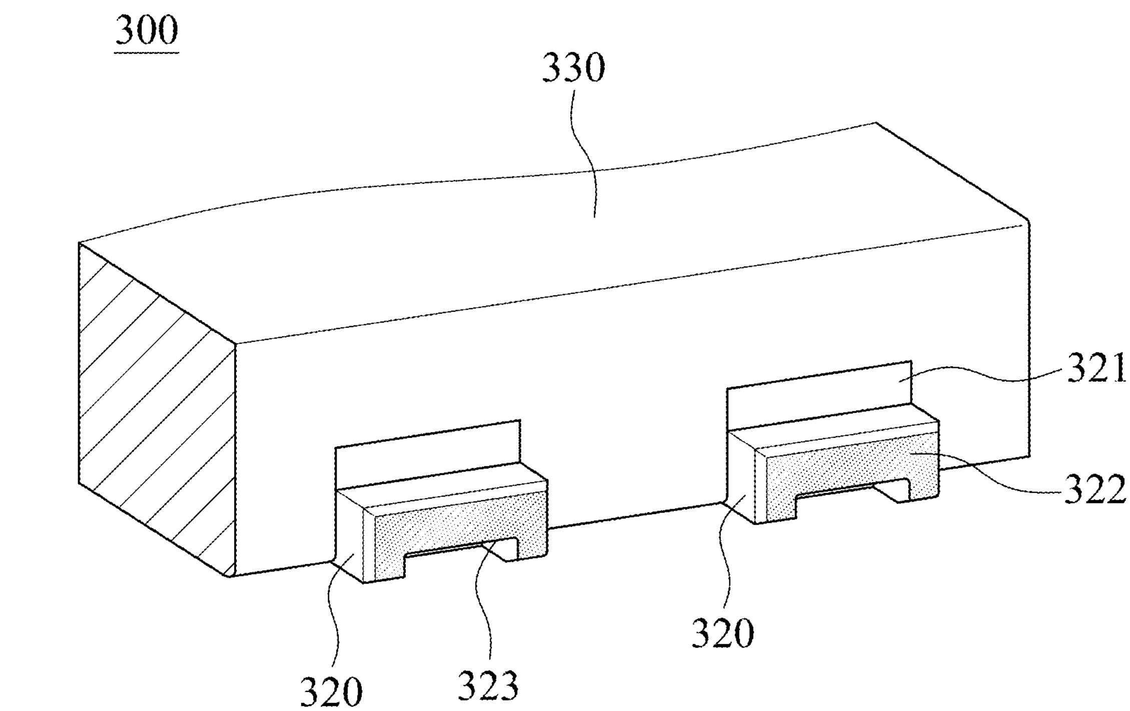

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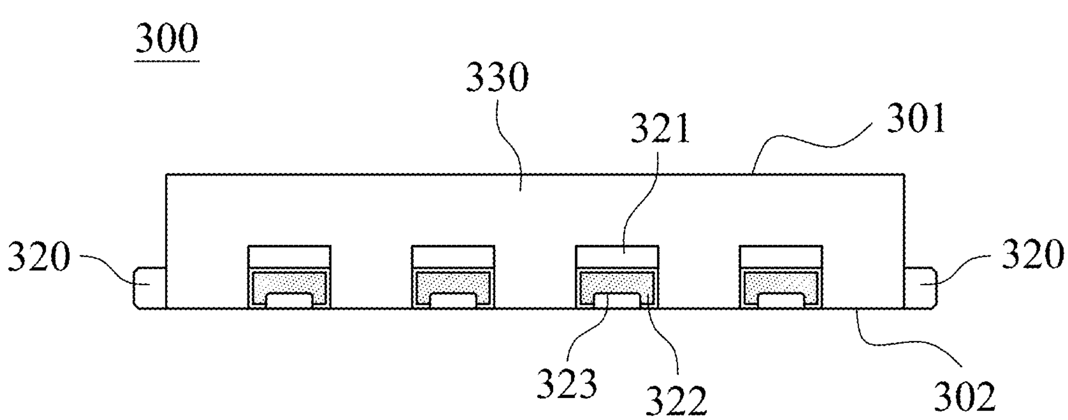

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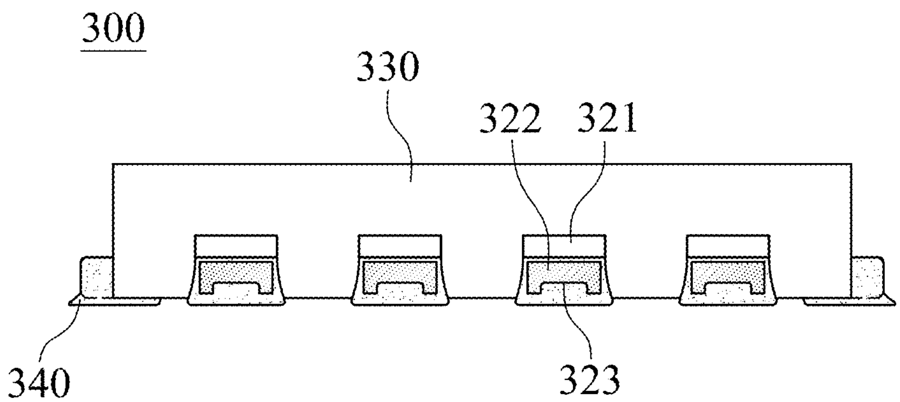

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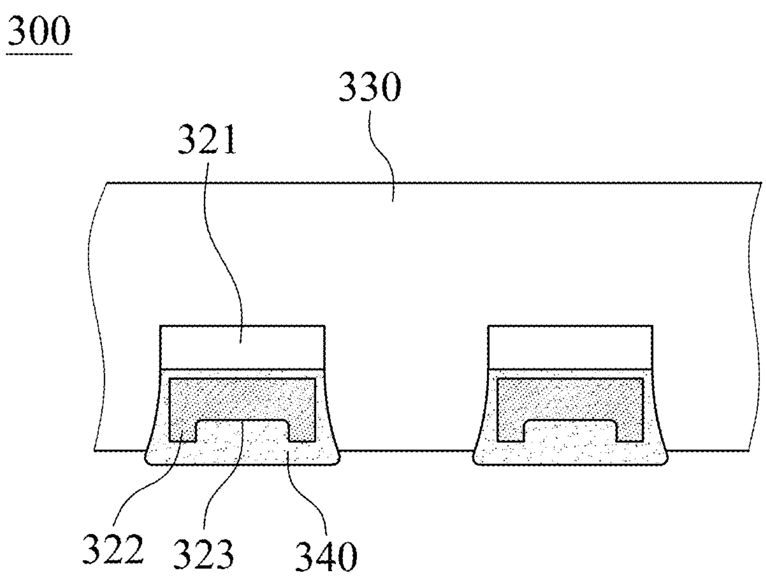

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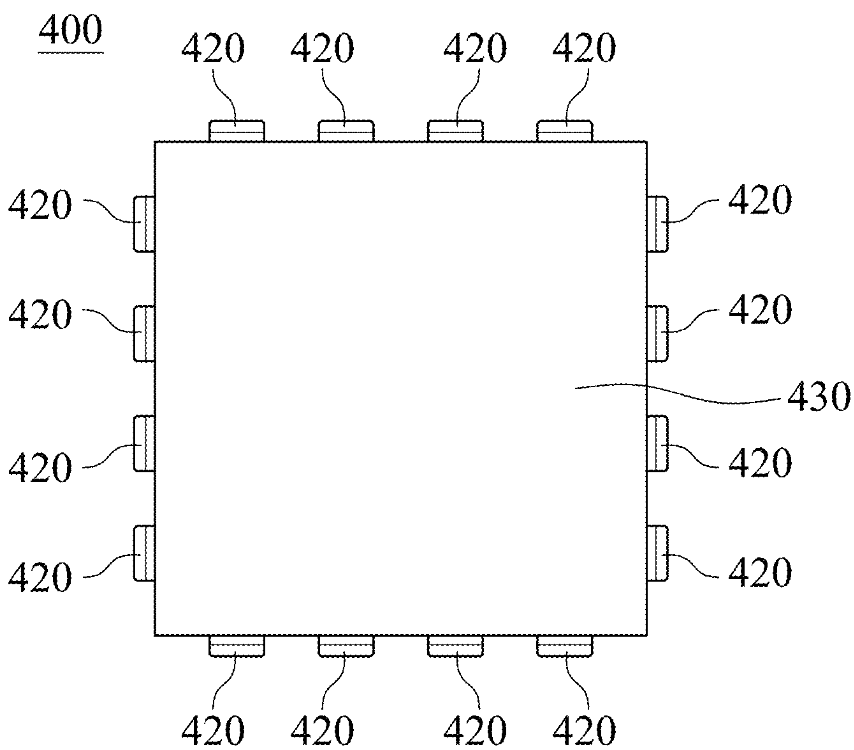
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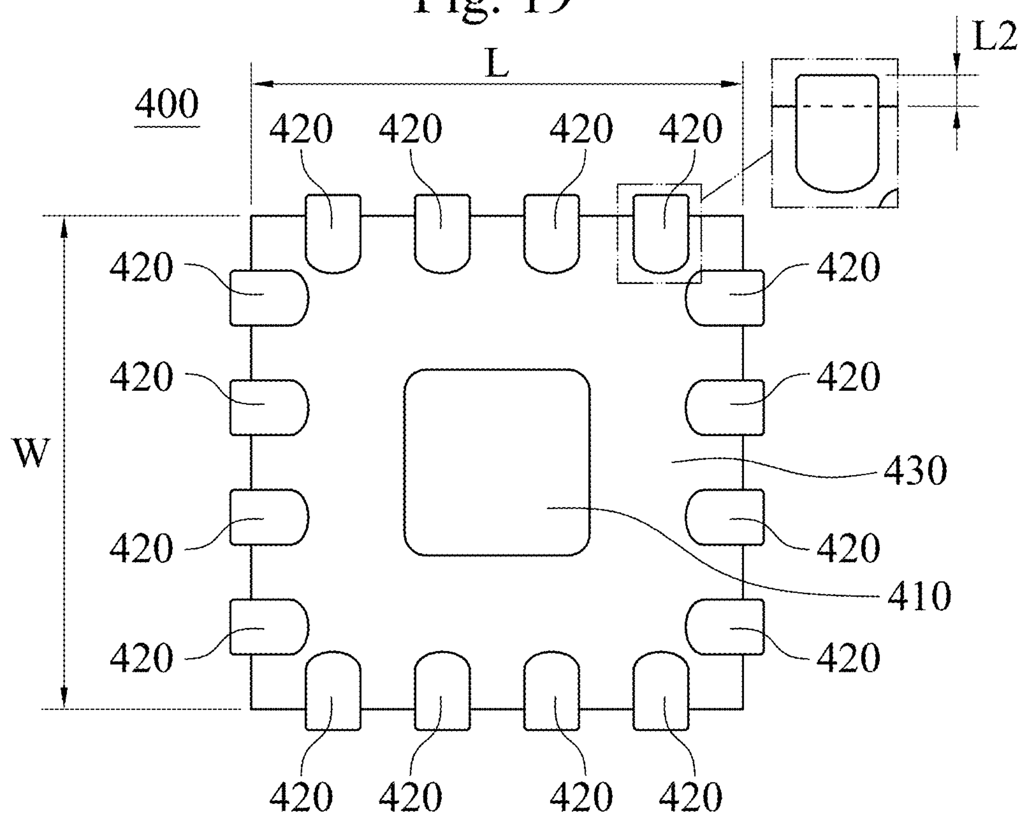
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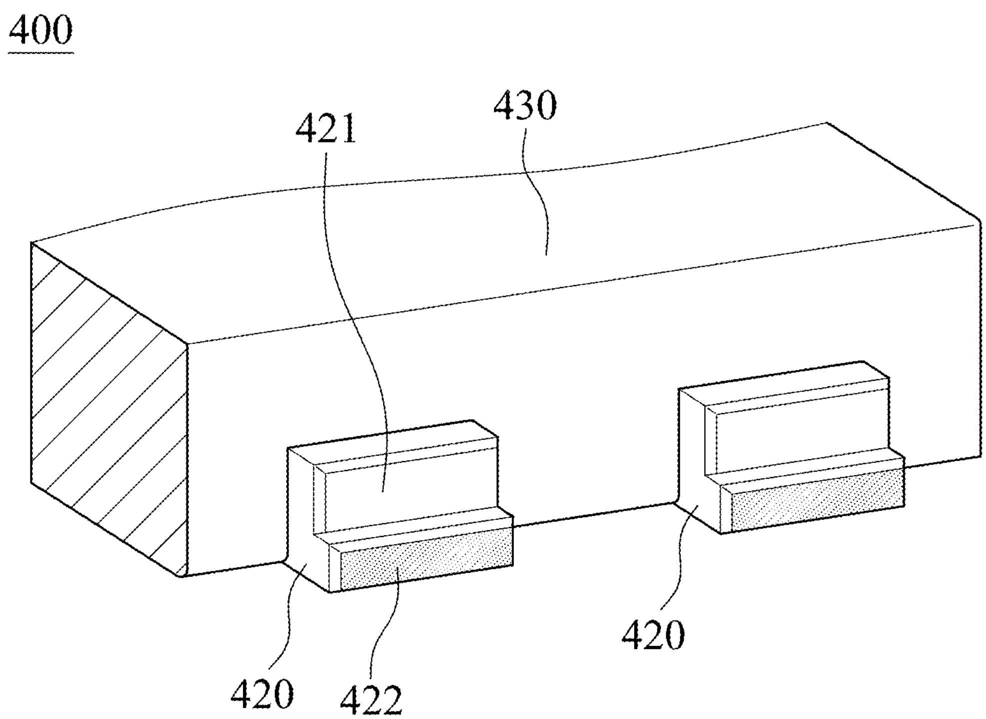

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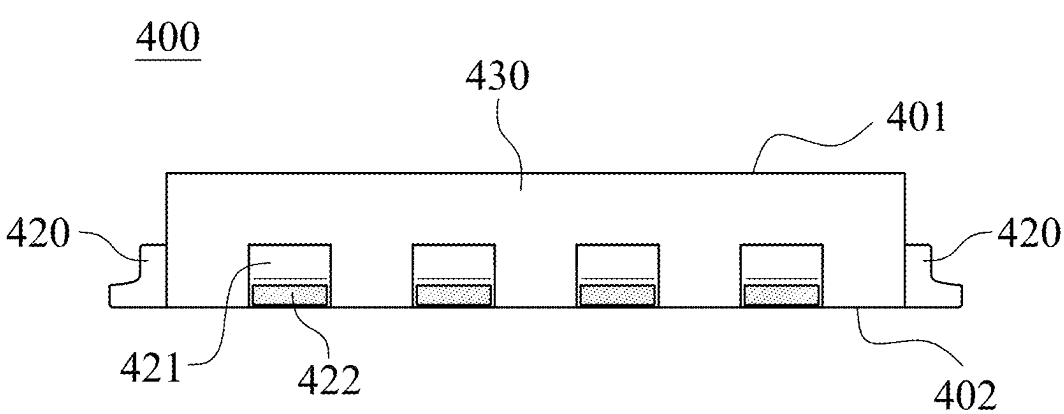

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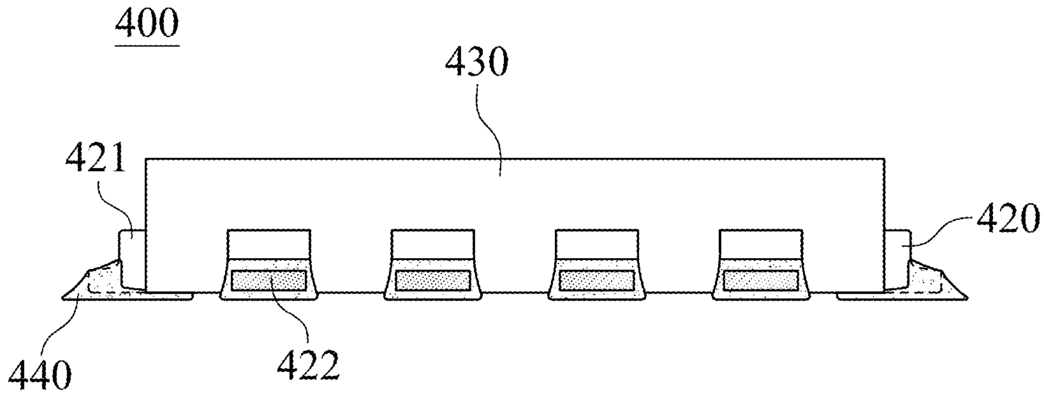

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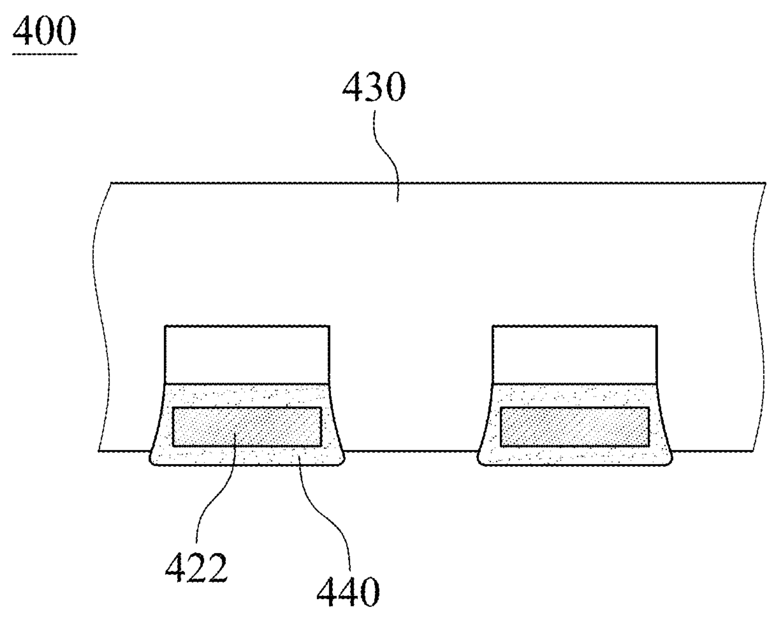

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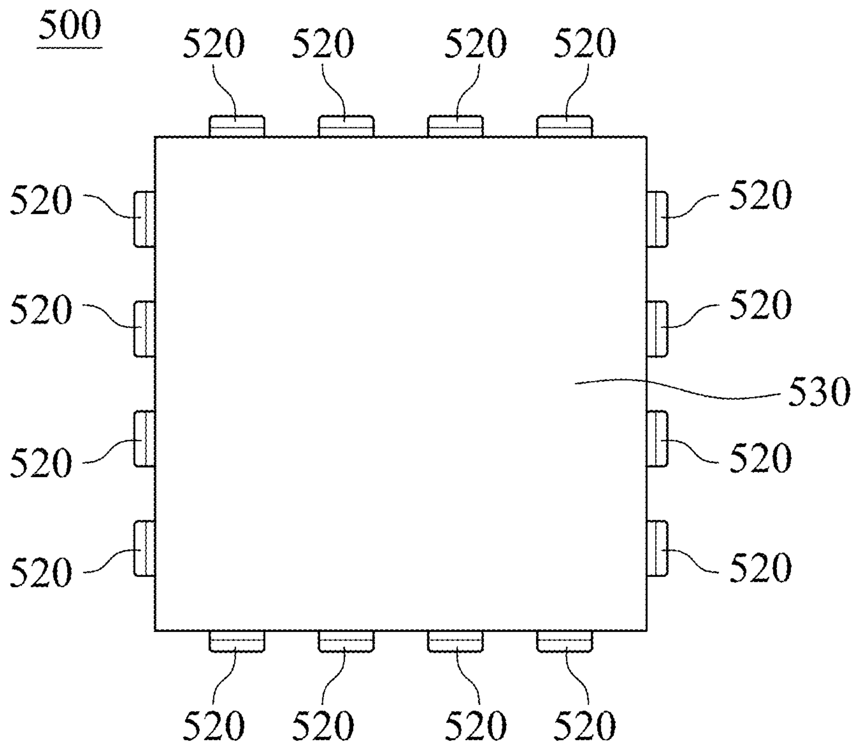
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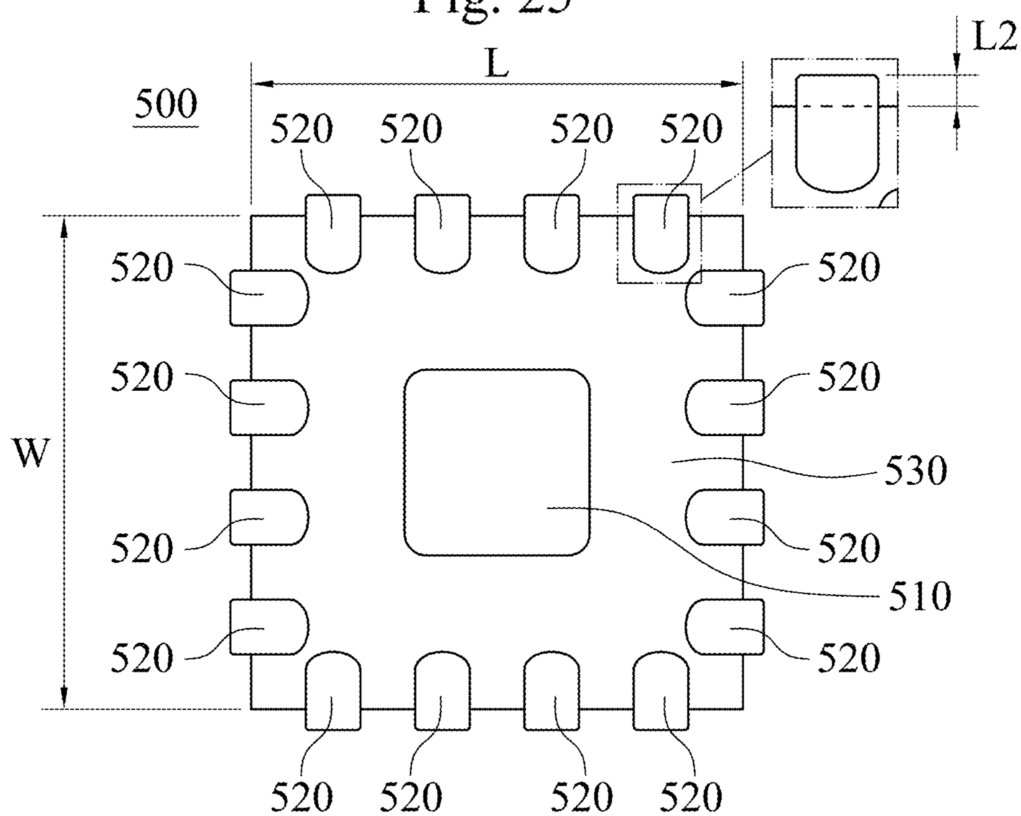
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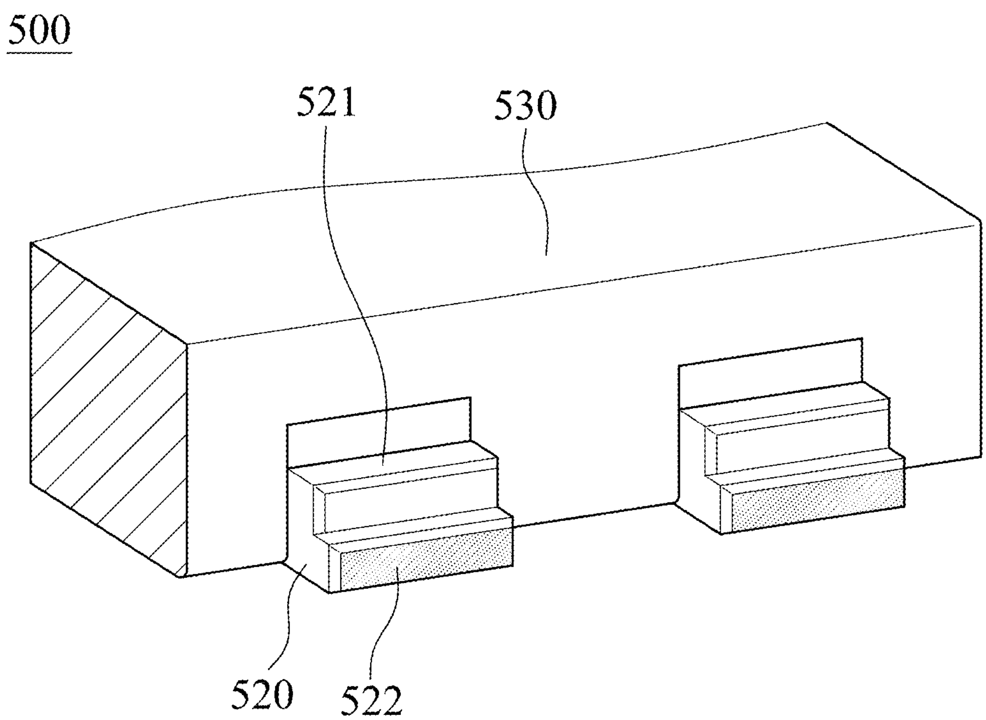

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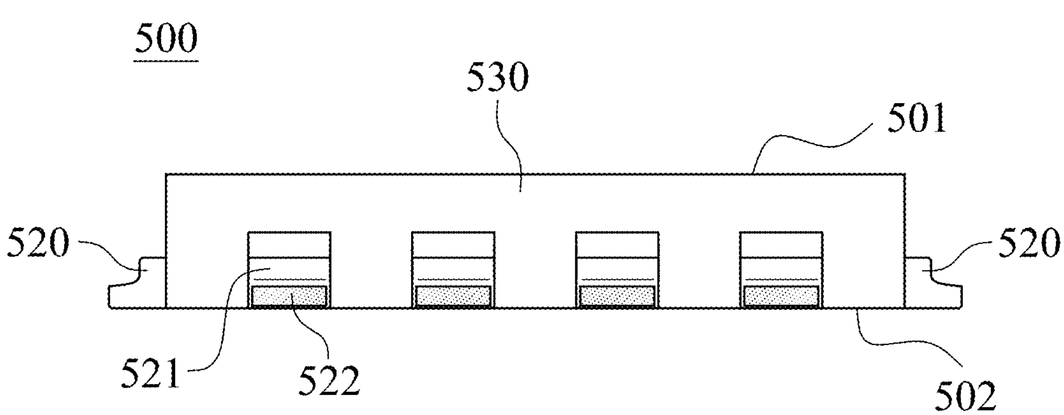

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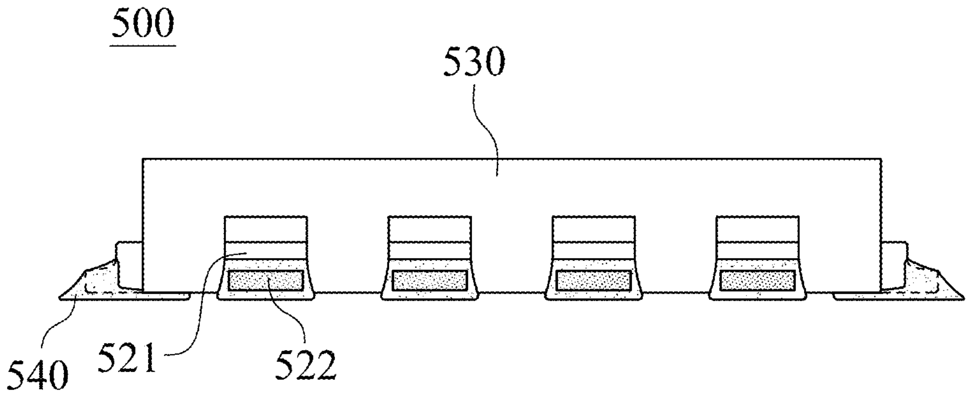

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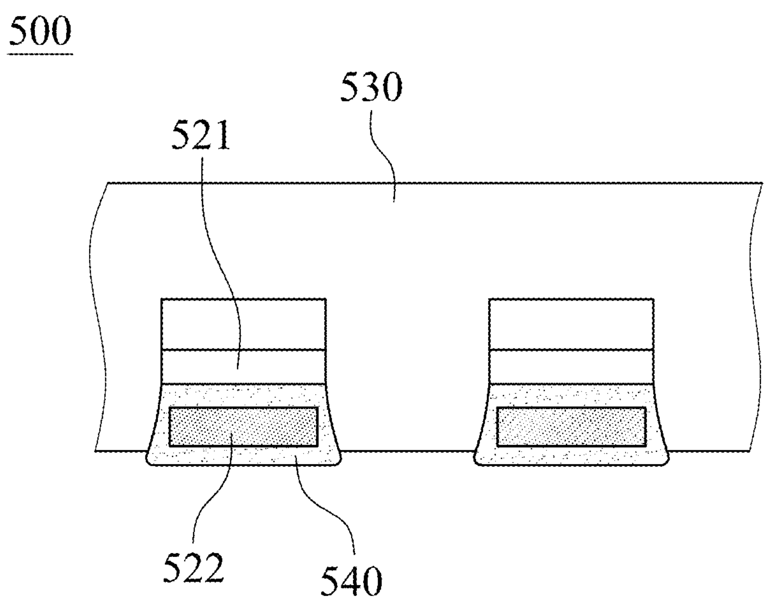

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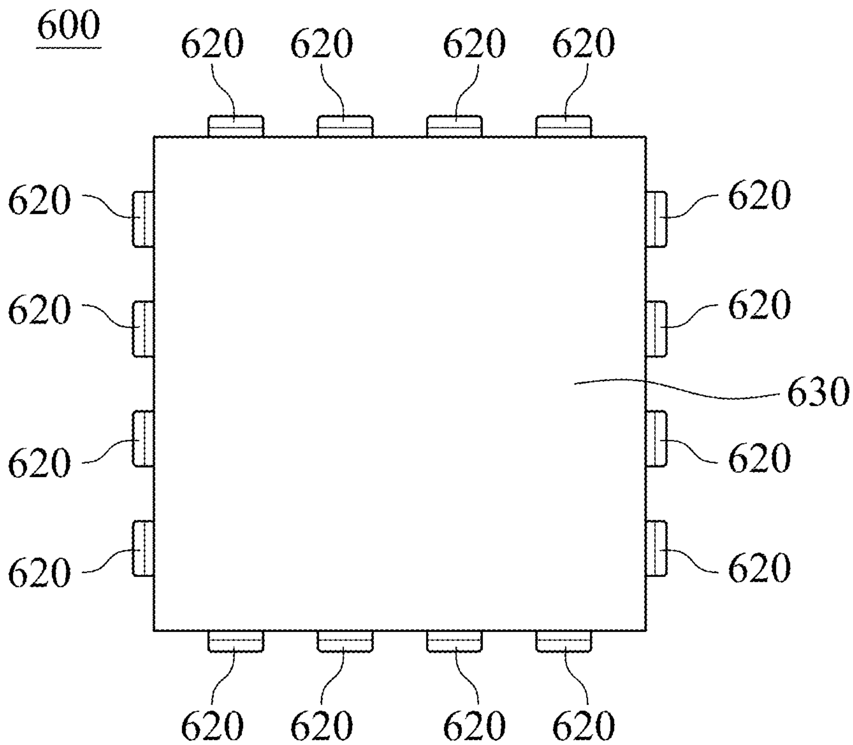
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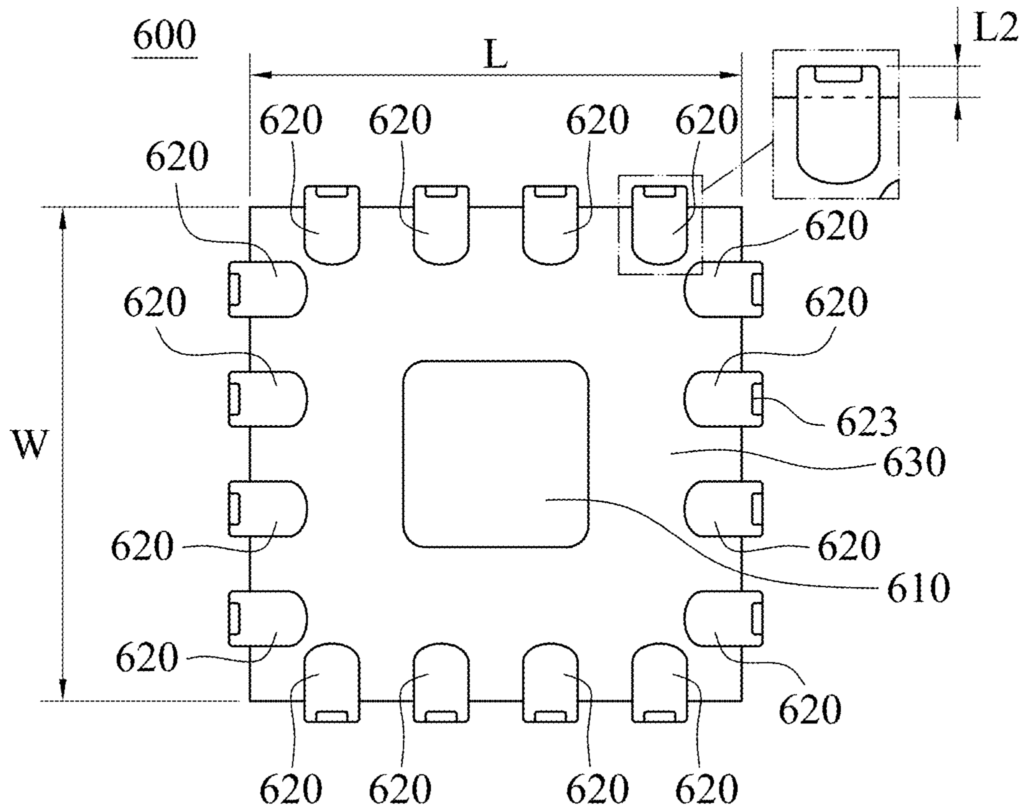
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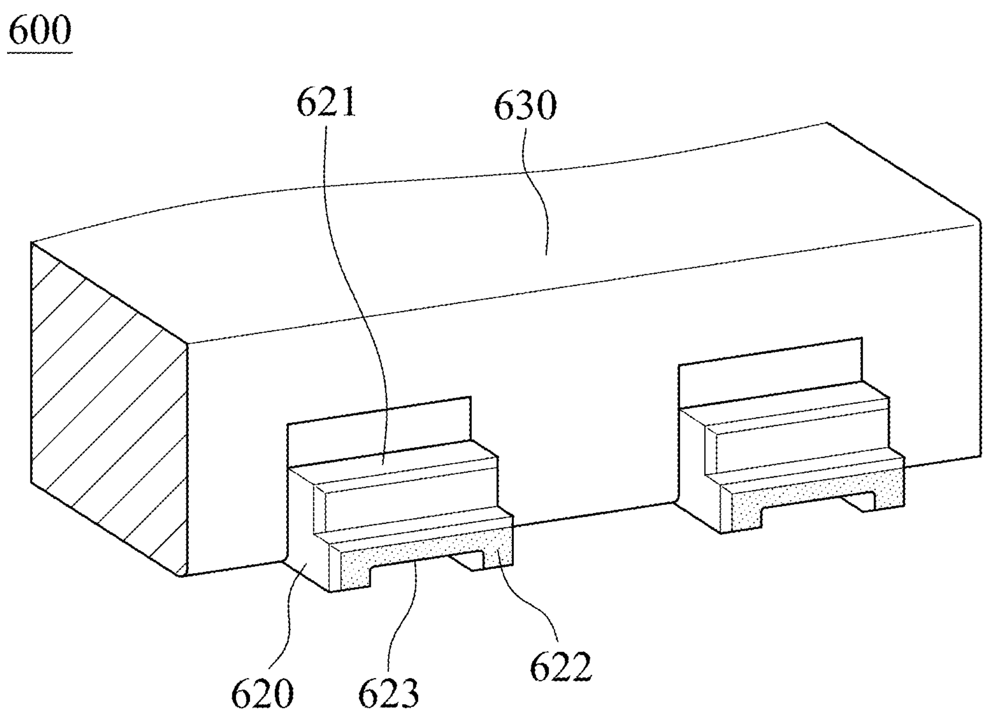

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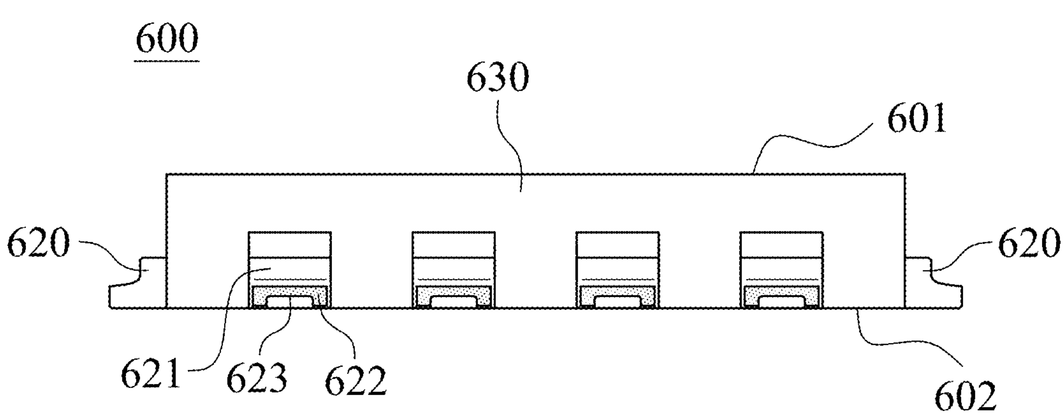

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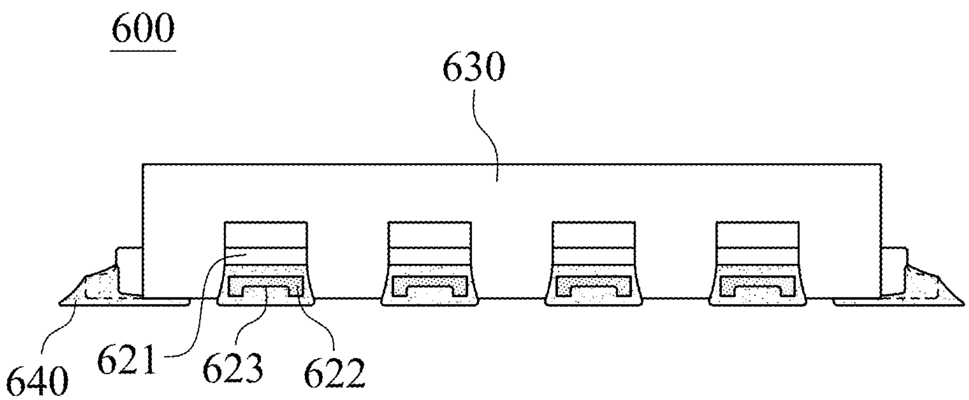

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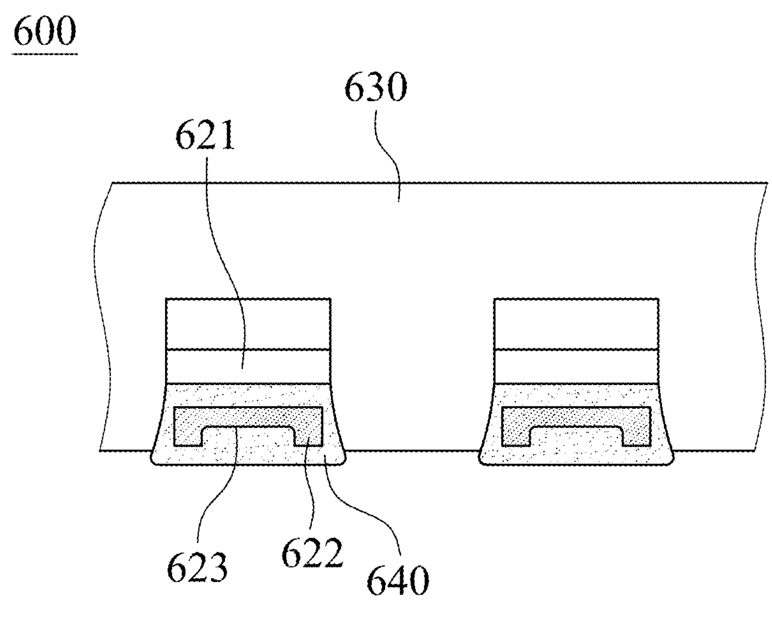

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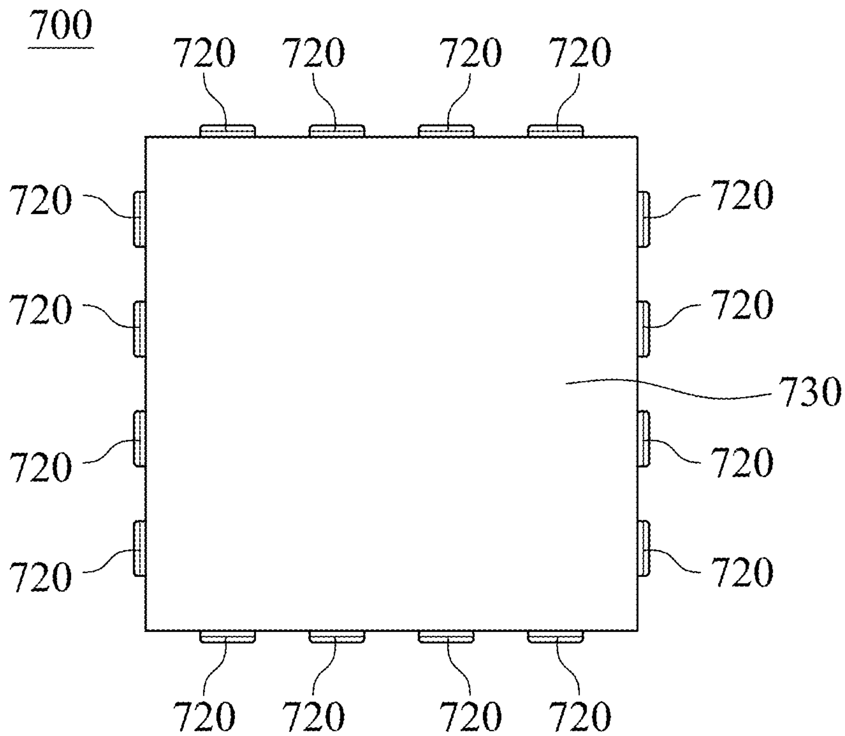
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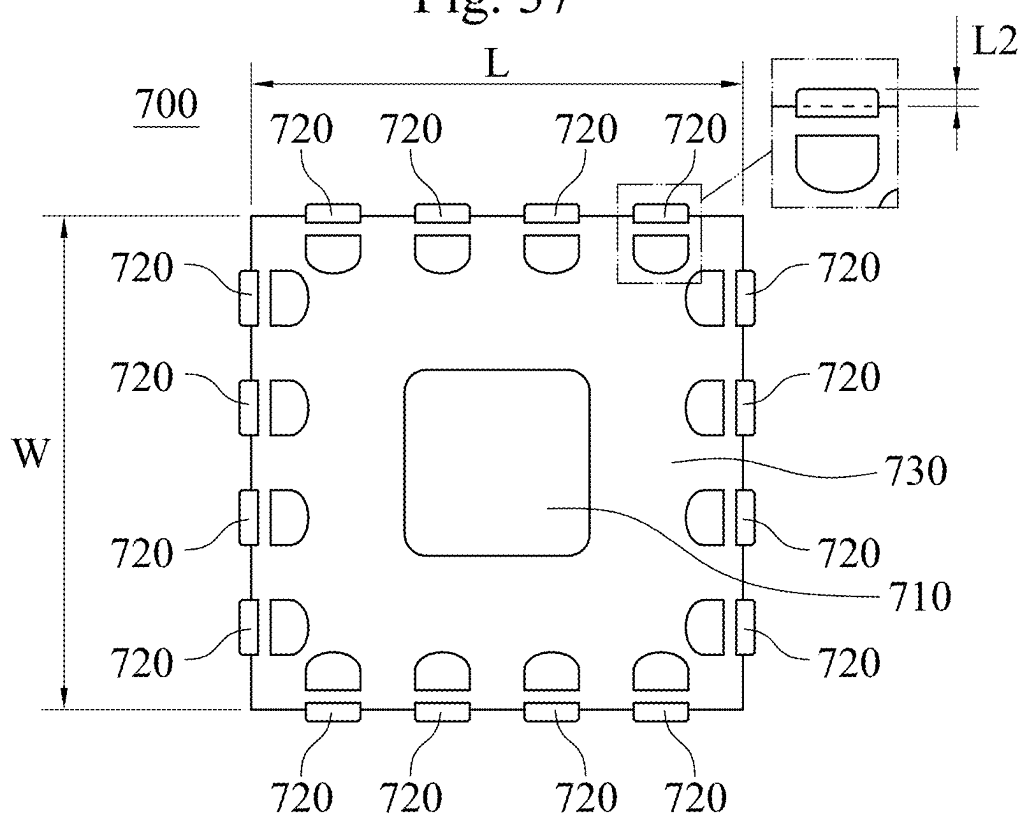
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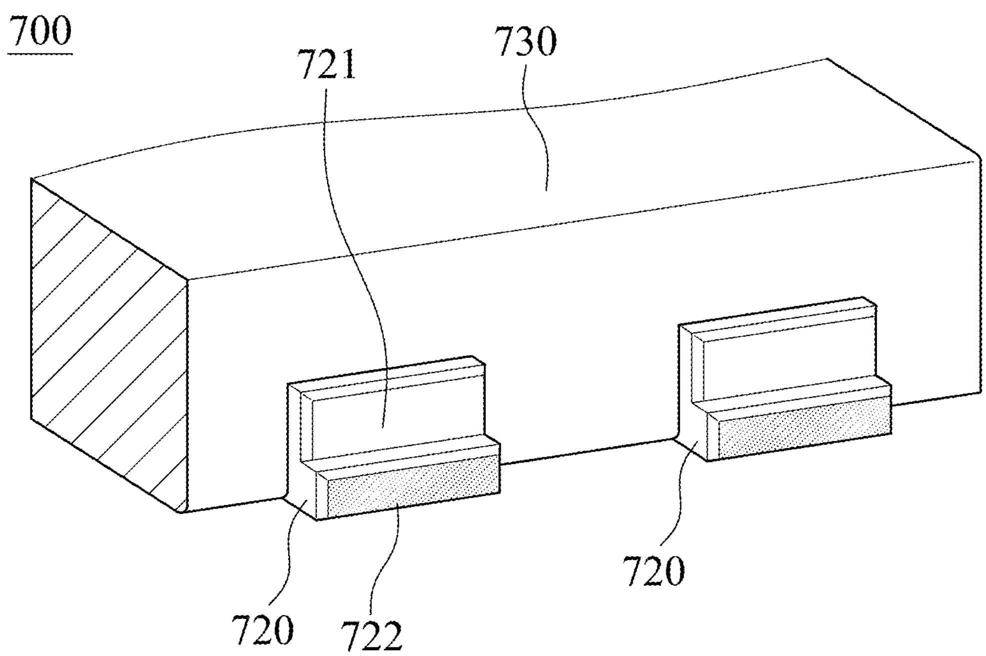

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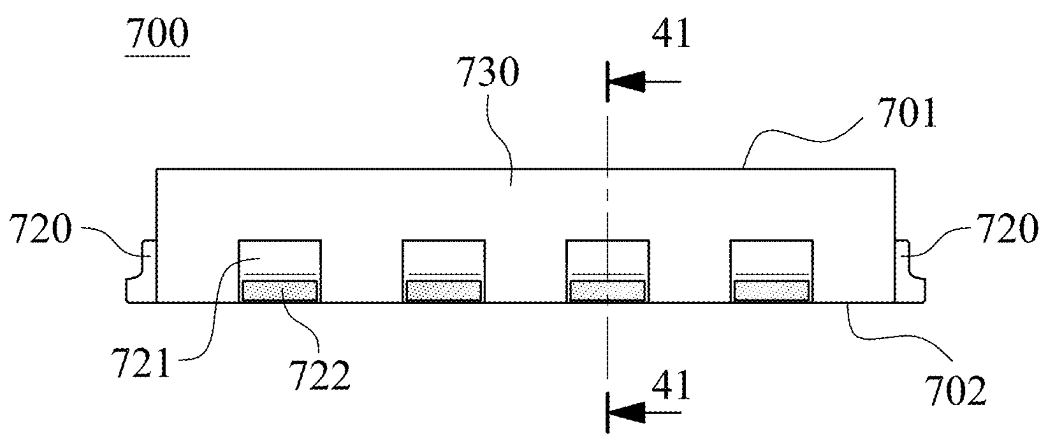

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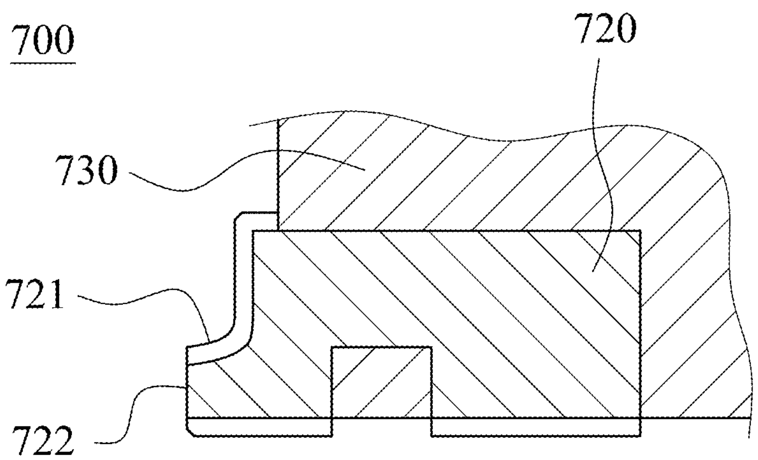

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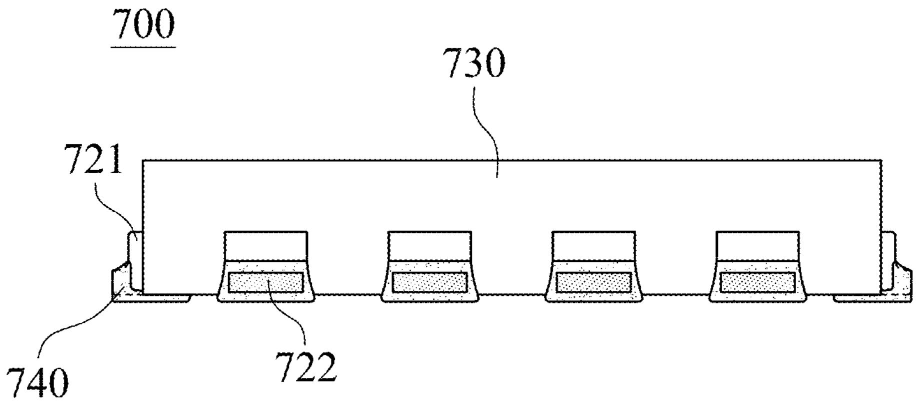

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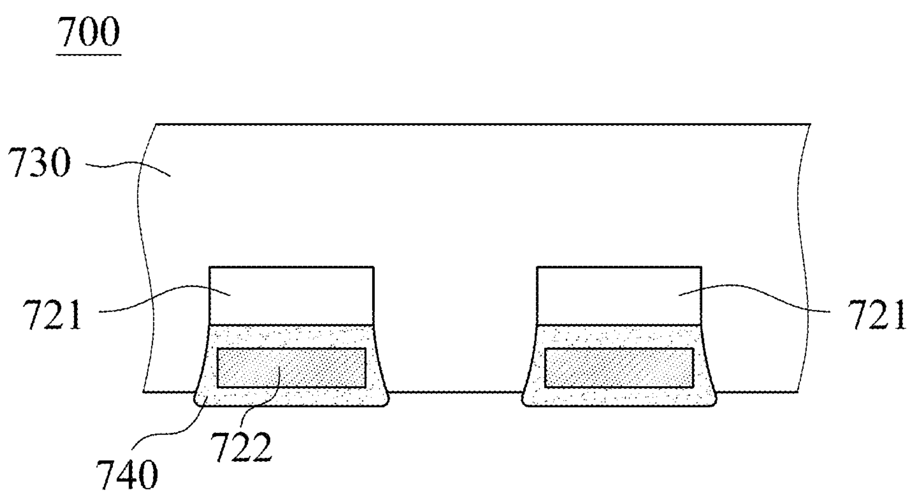

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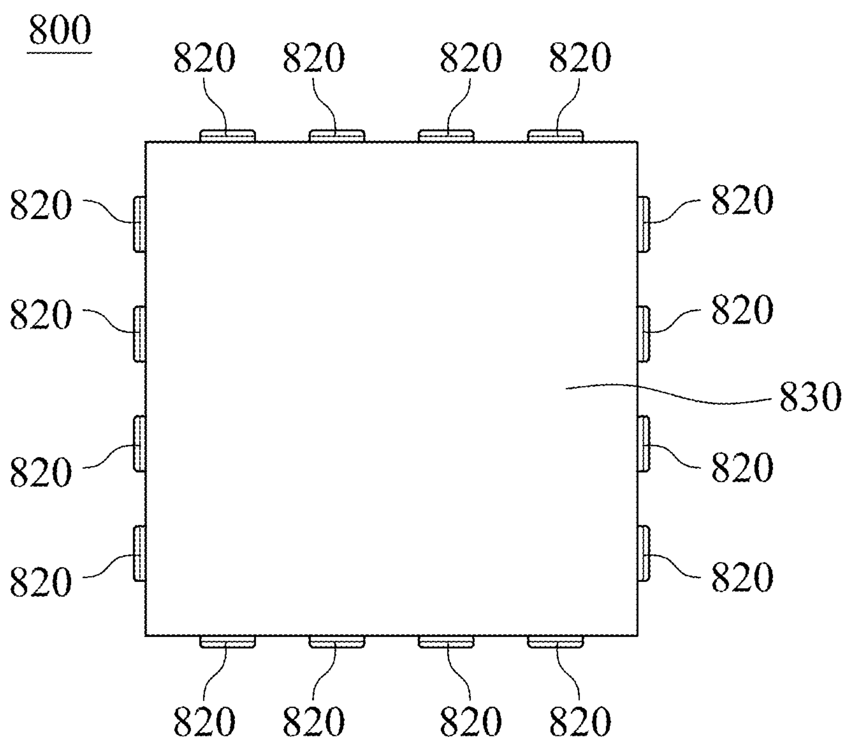
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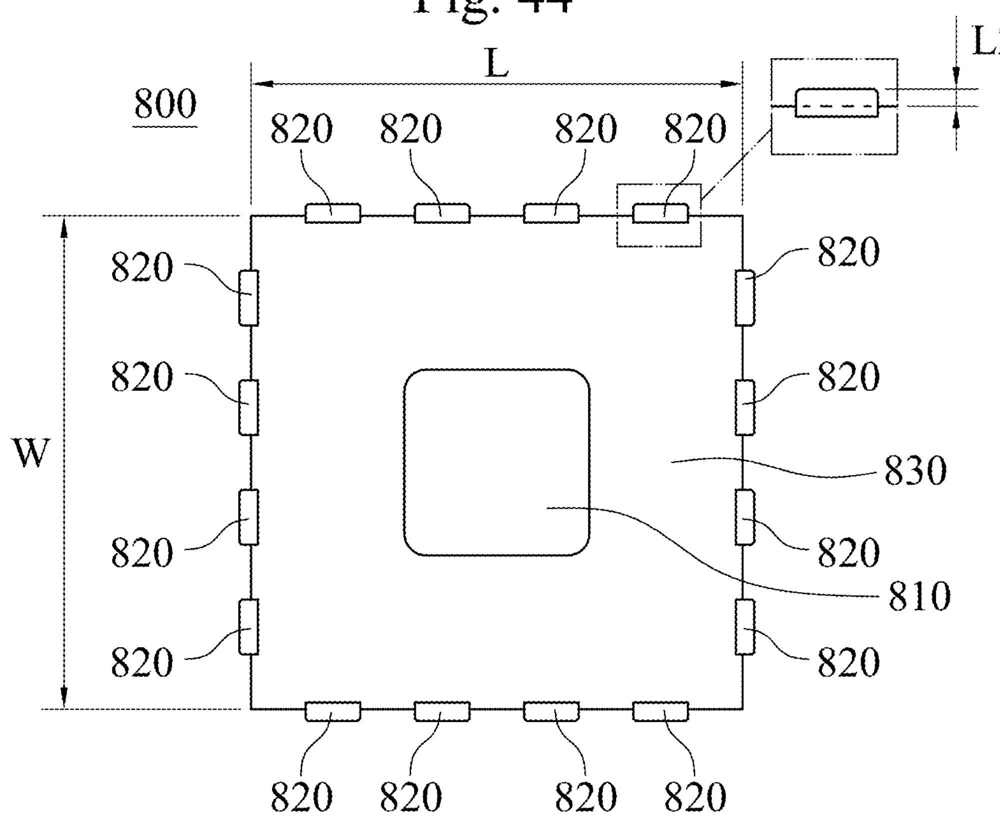
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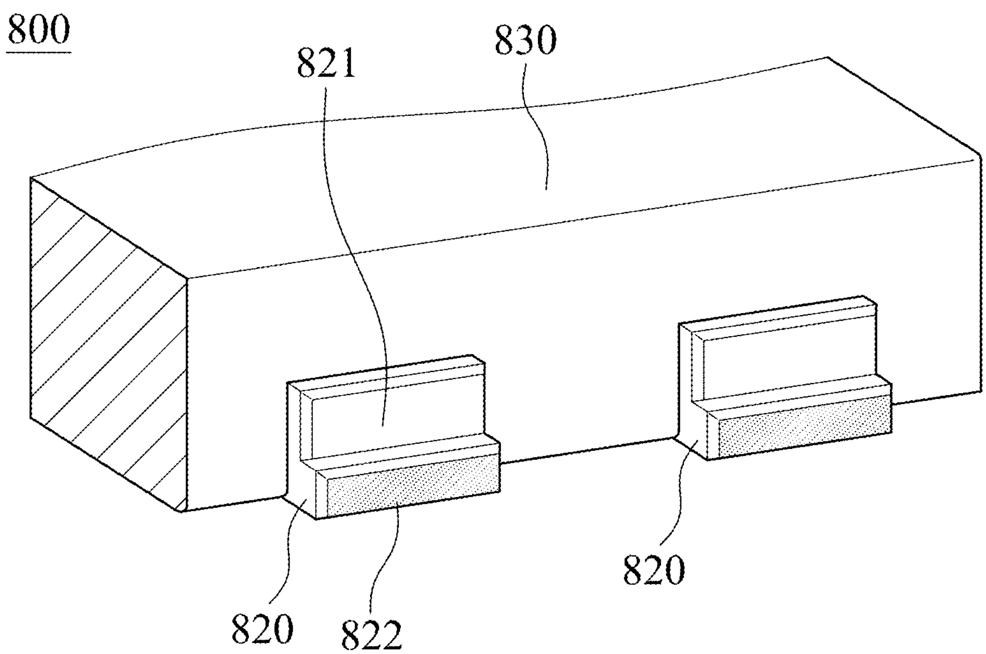
Fig. 45



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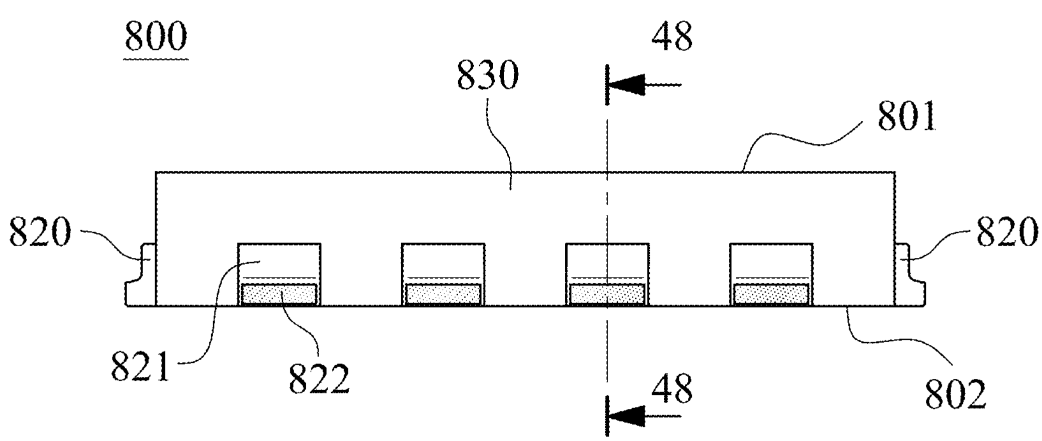

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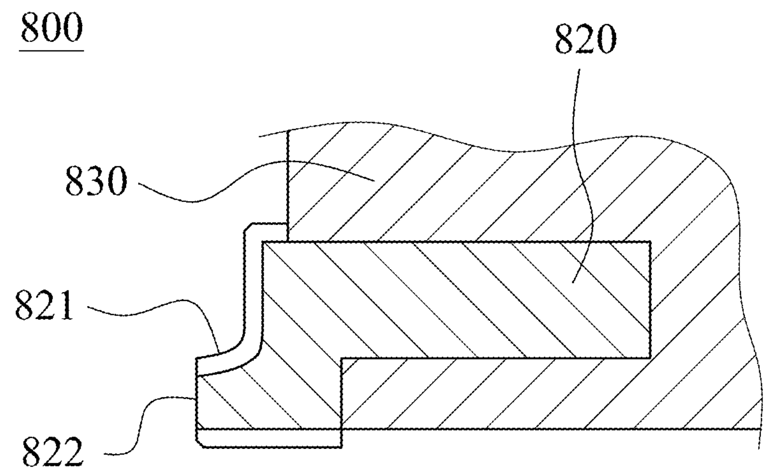

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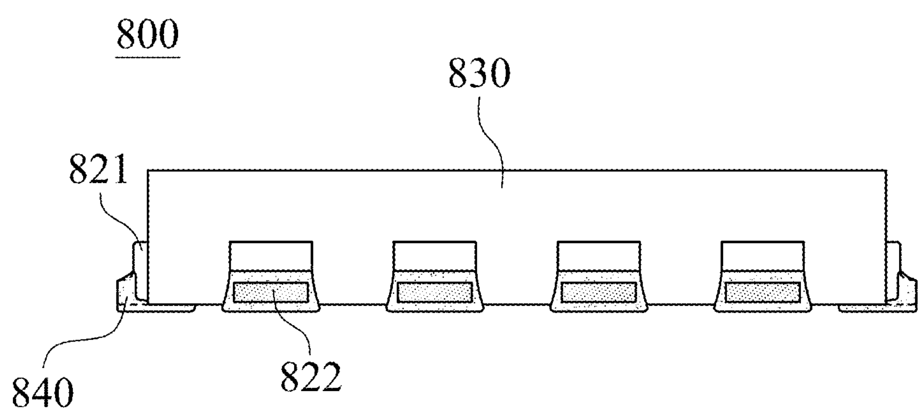

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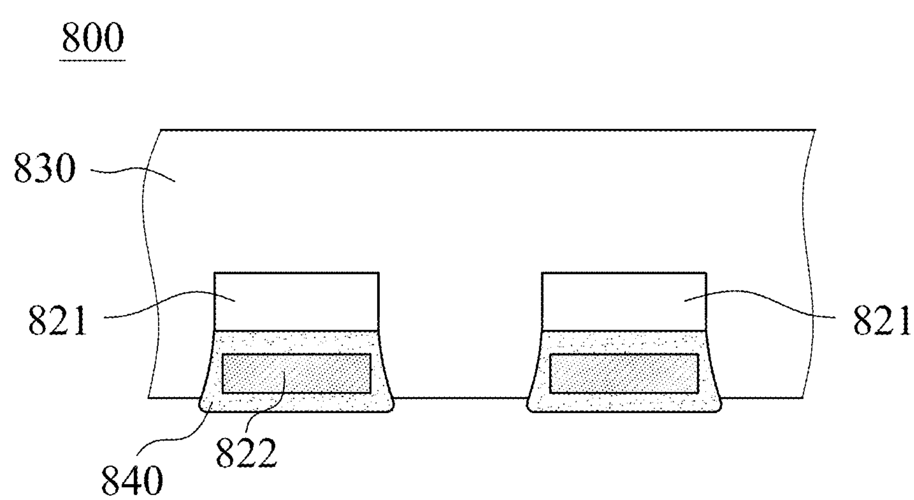

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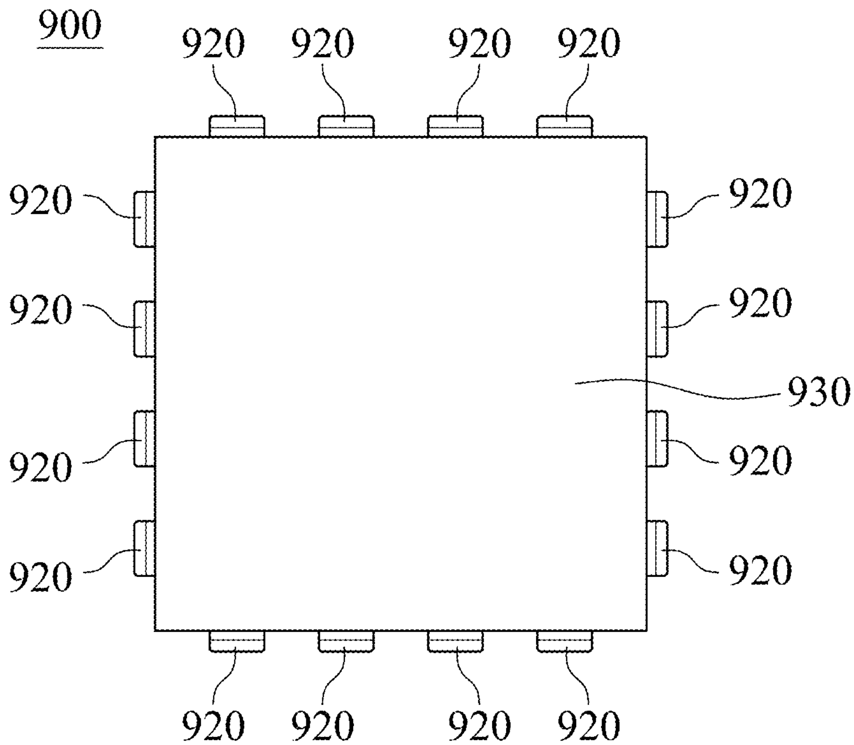
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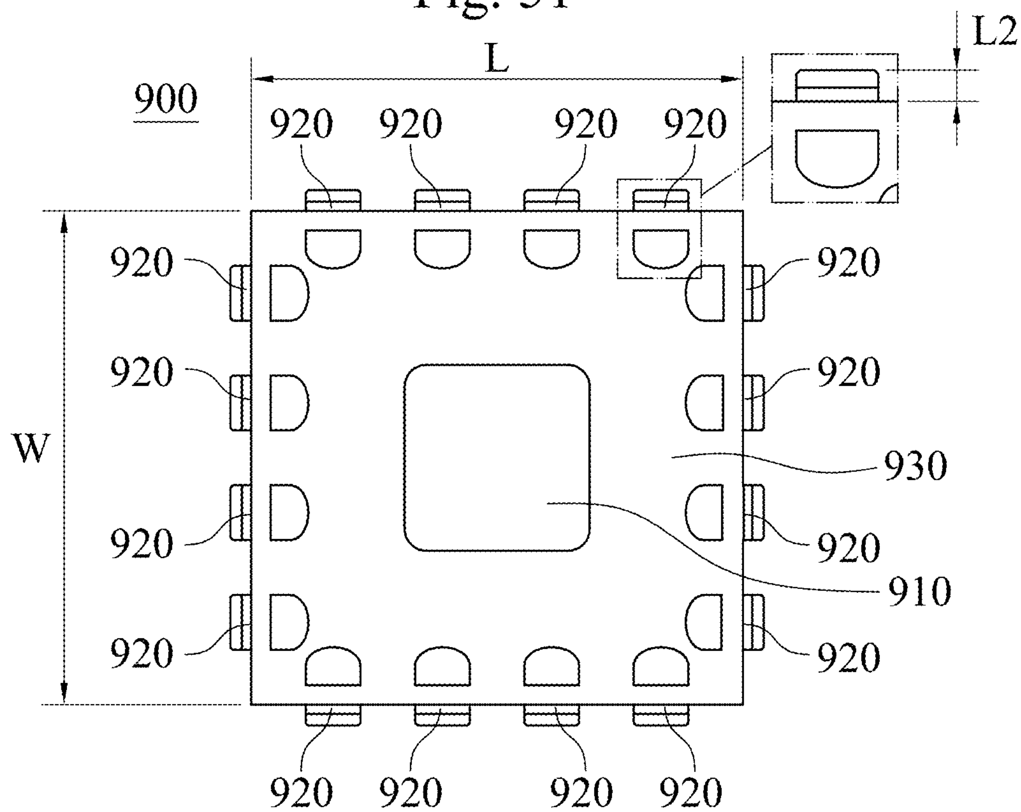
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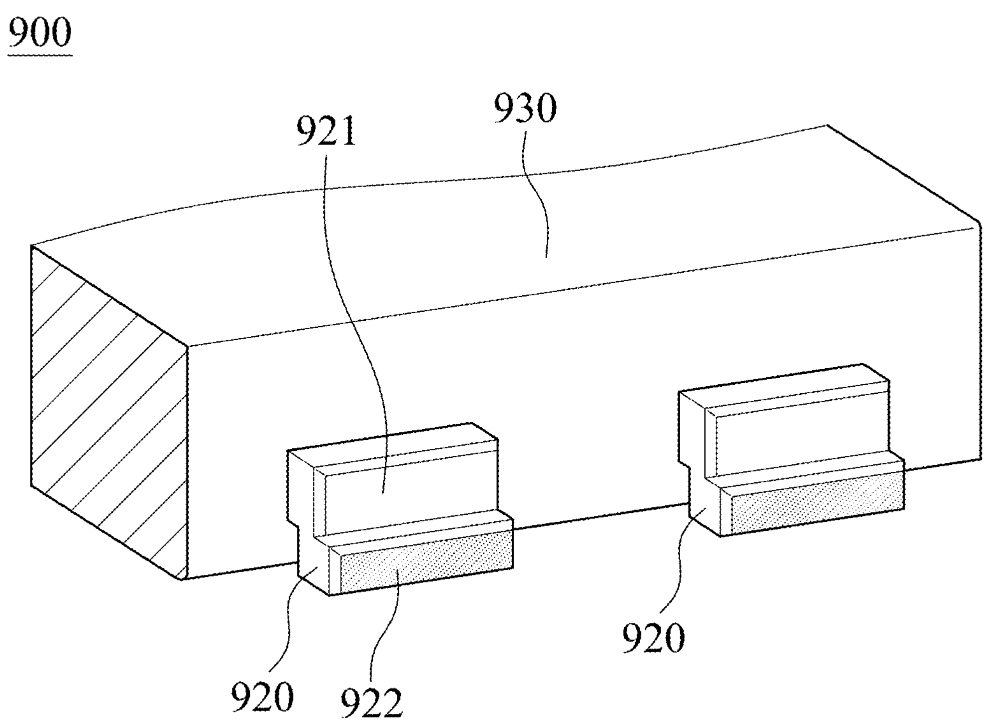
Fig. 52



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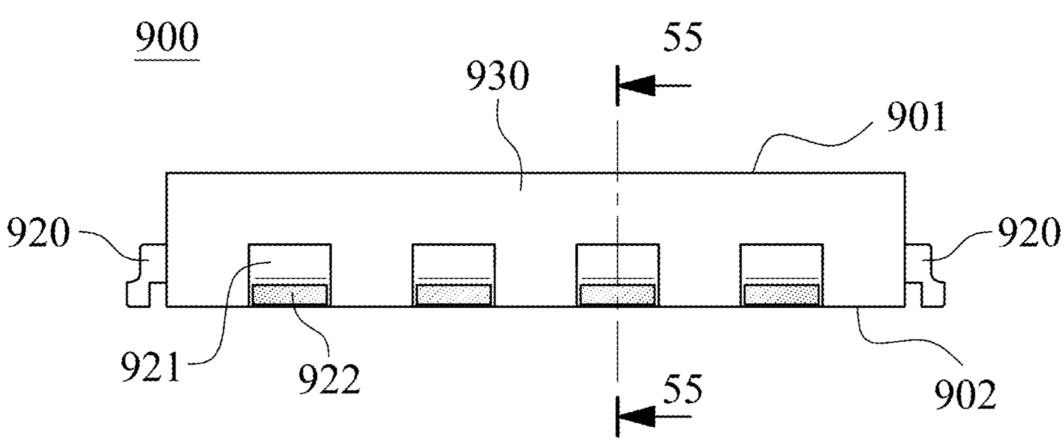

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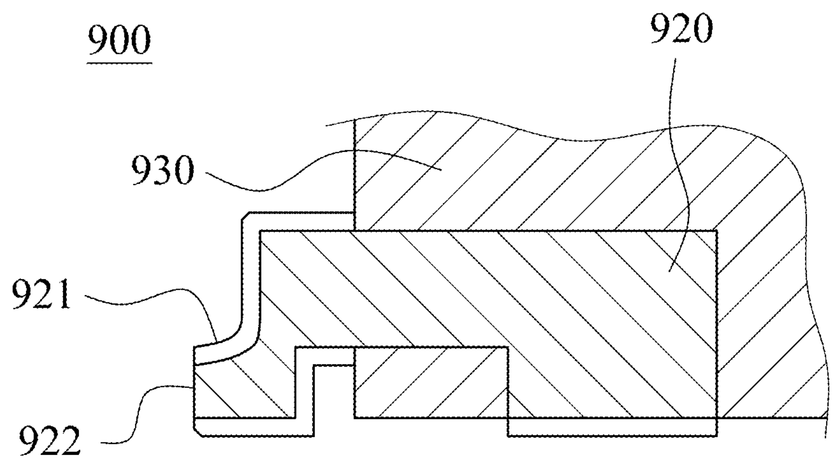

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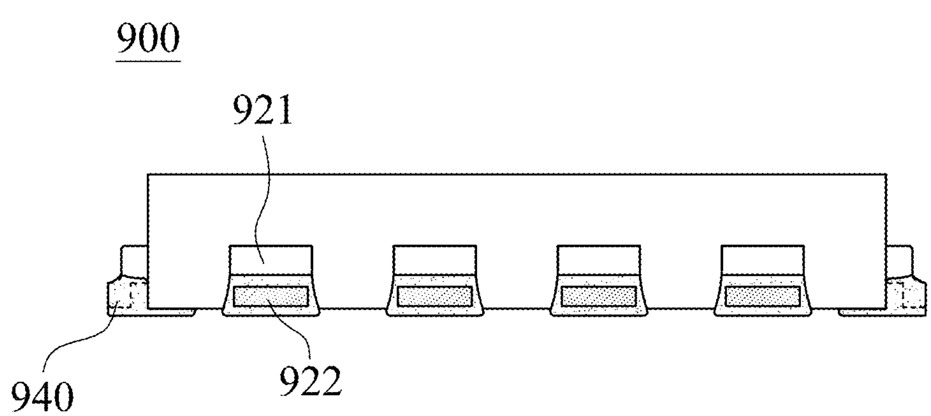

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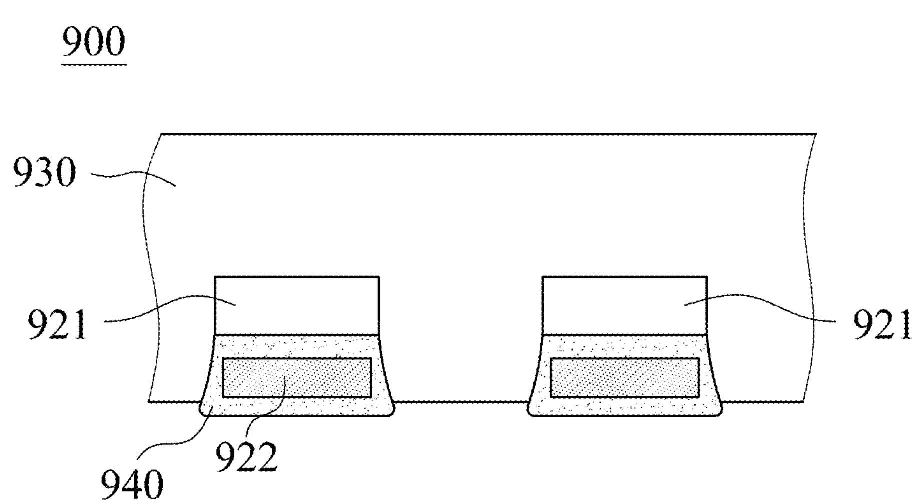

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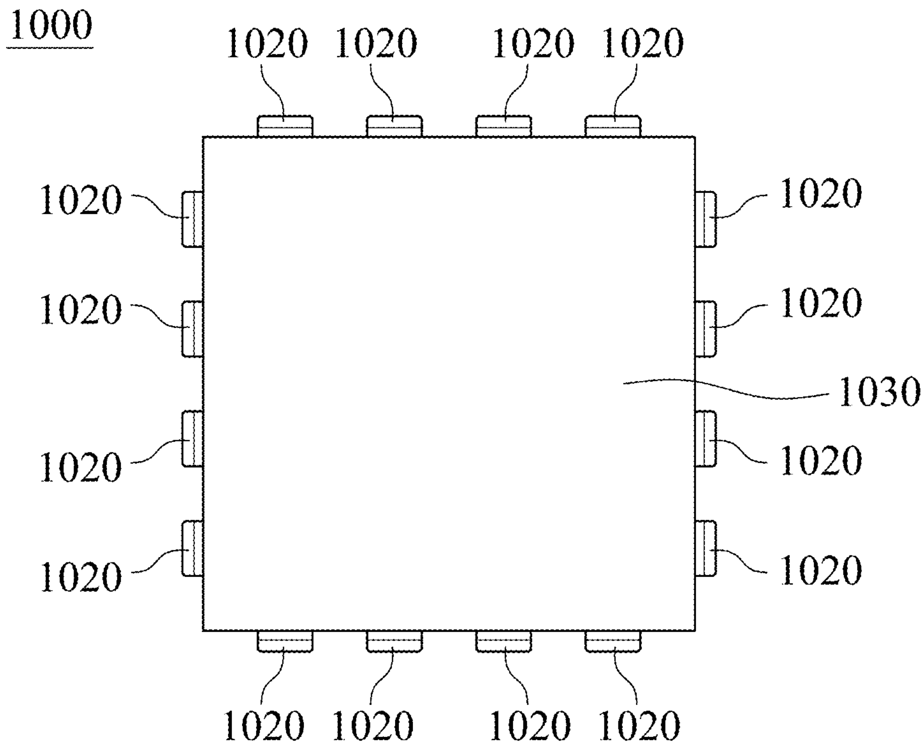
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Fig. 58

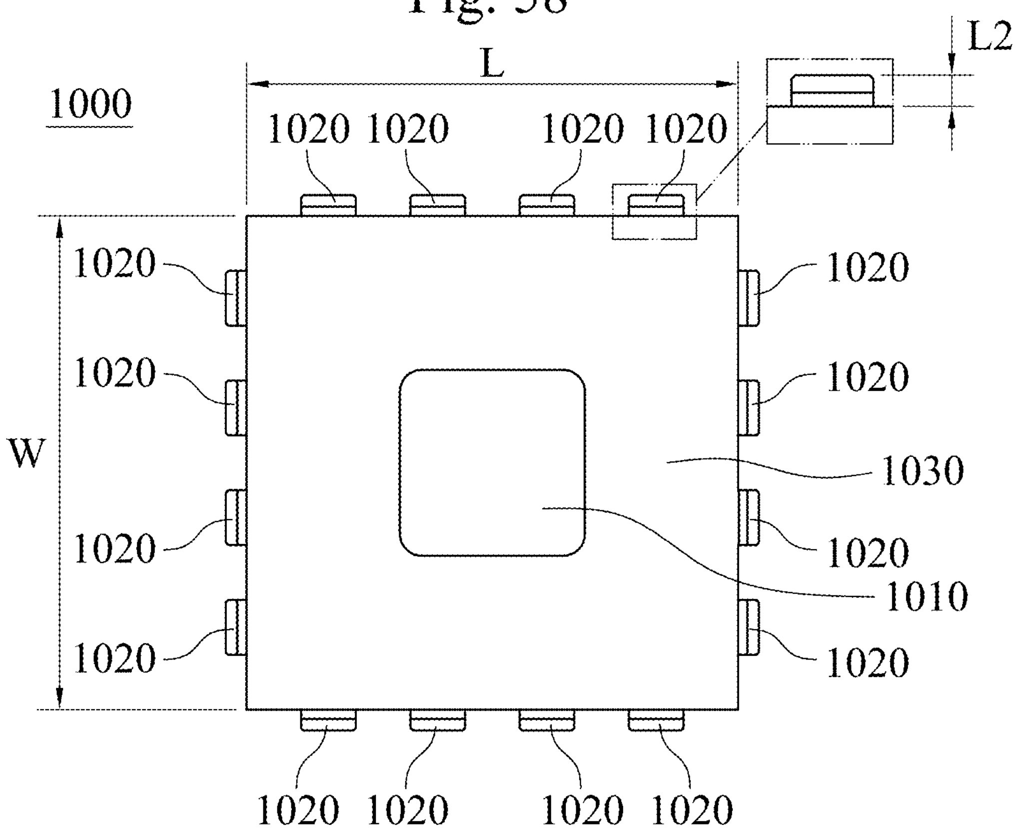
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Fig. 59

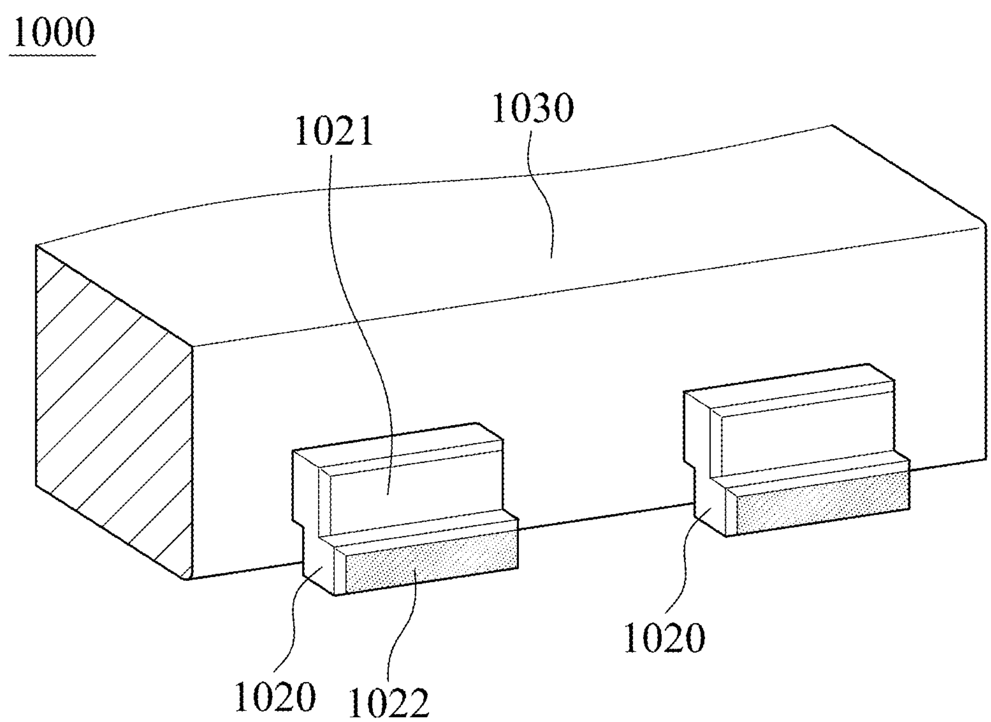
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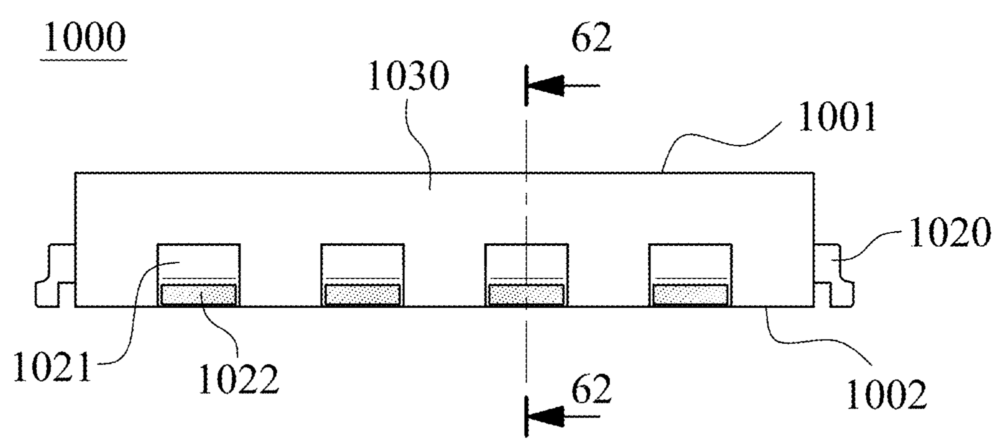
Fig. 60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1002

Fig. 61

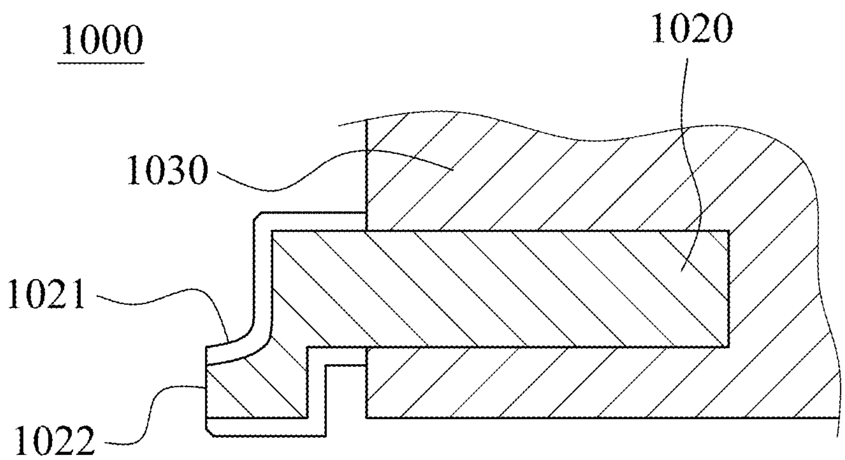


Fig. 62

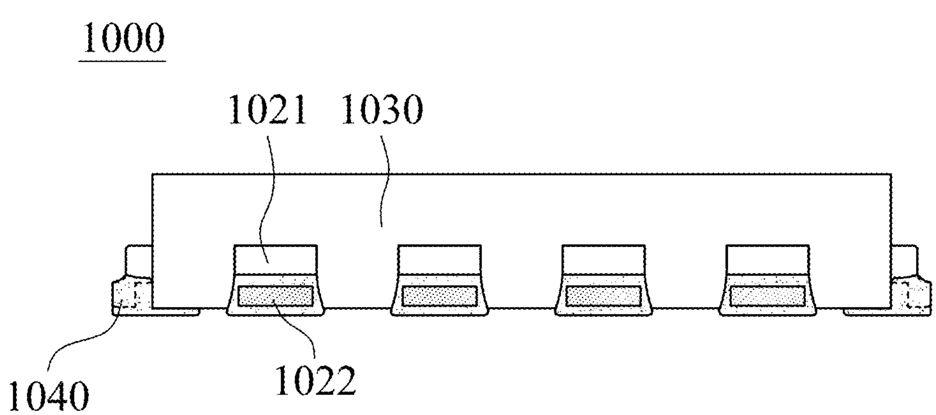
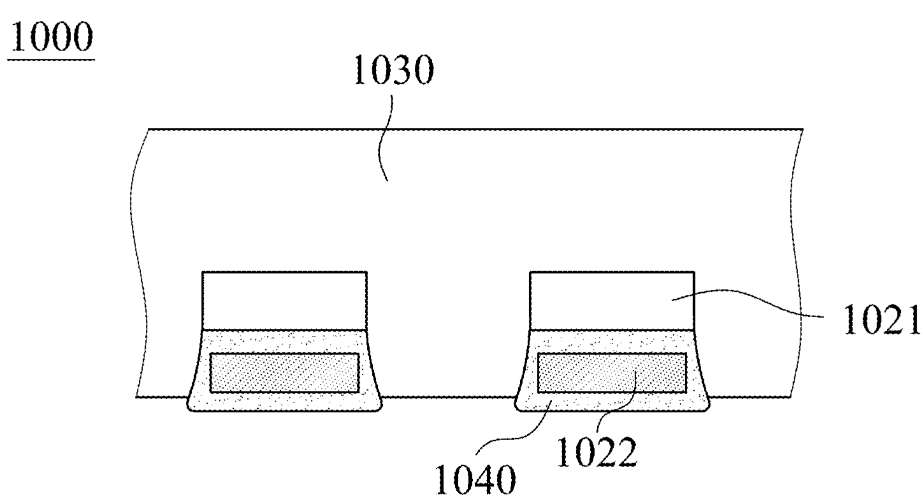


Fig. 63



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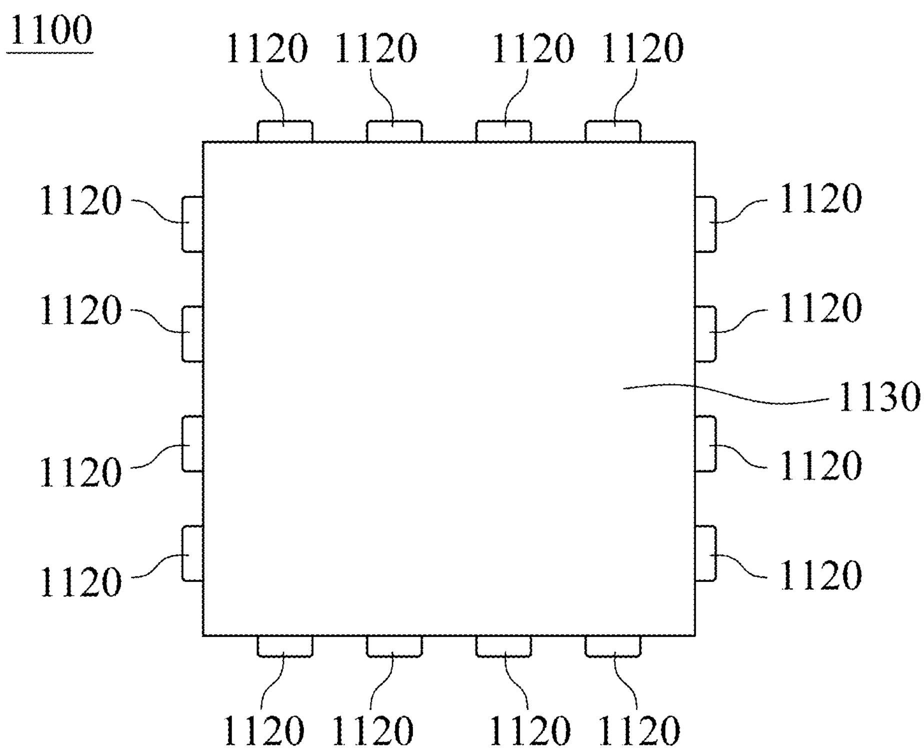
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Fig. 65

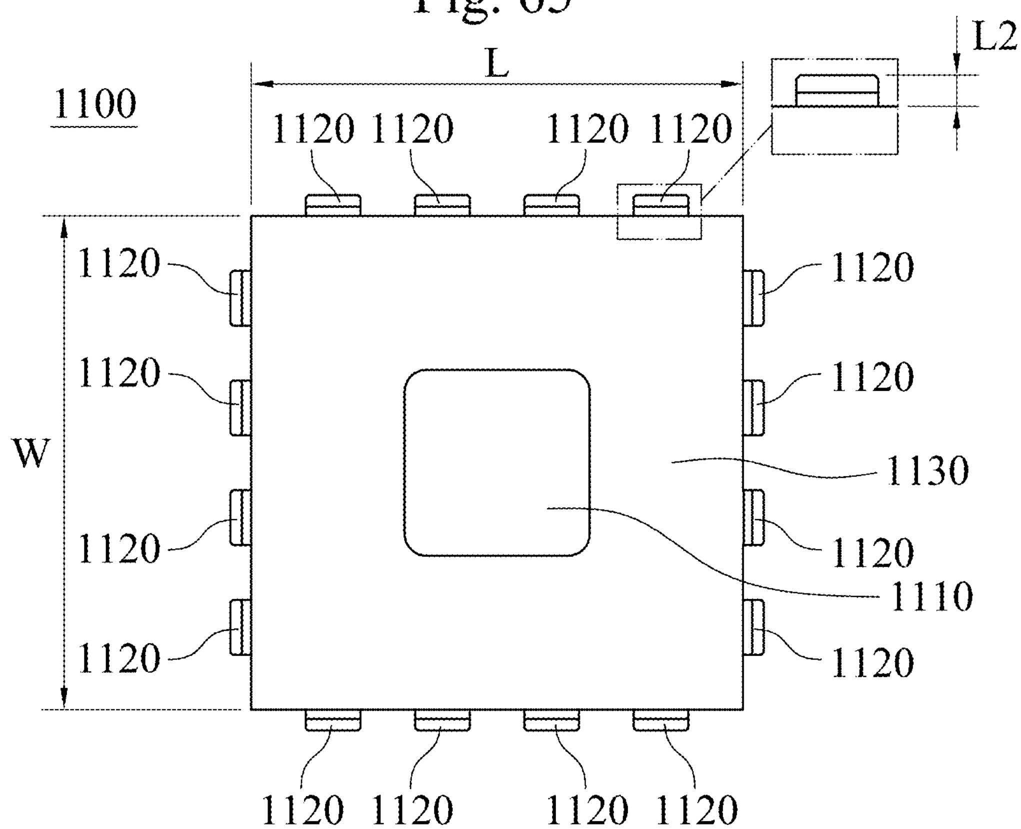
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Fig. 66

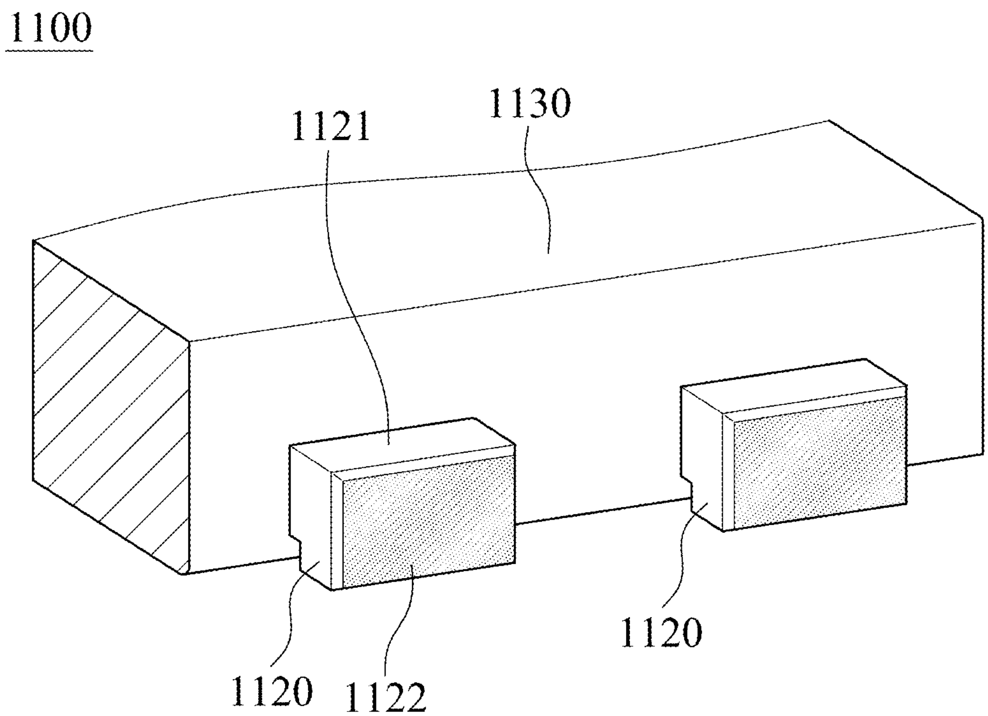

Fig. 67

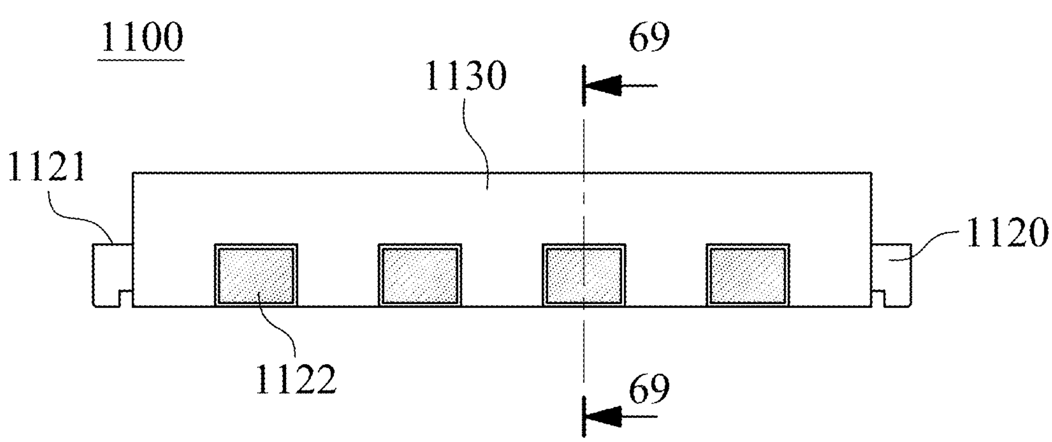

Fig. 68

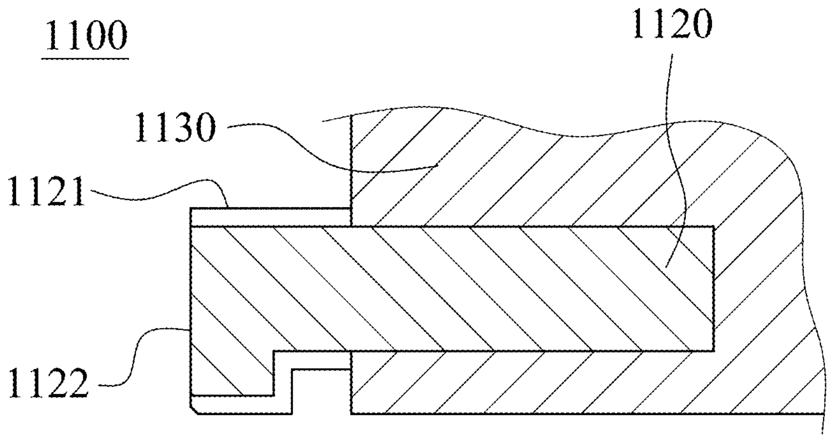

Fig. 69

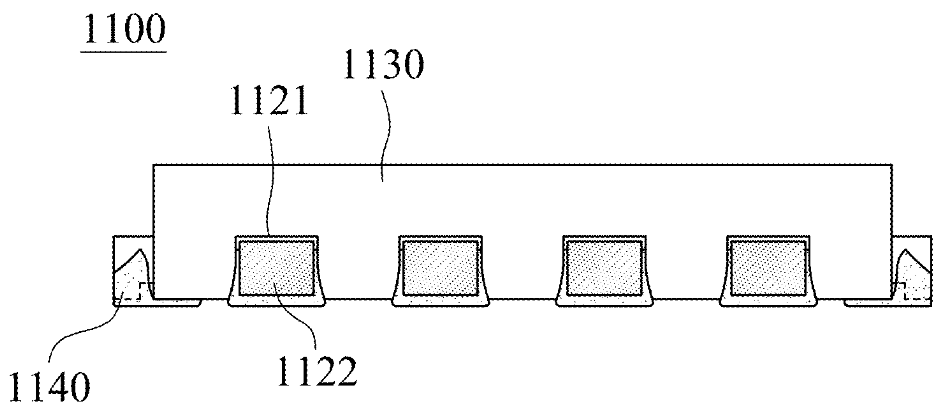

Fig. 70

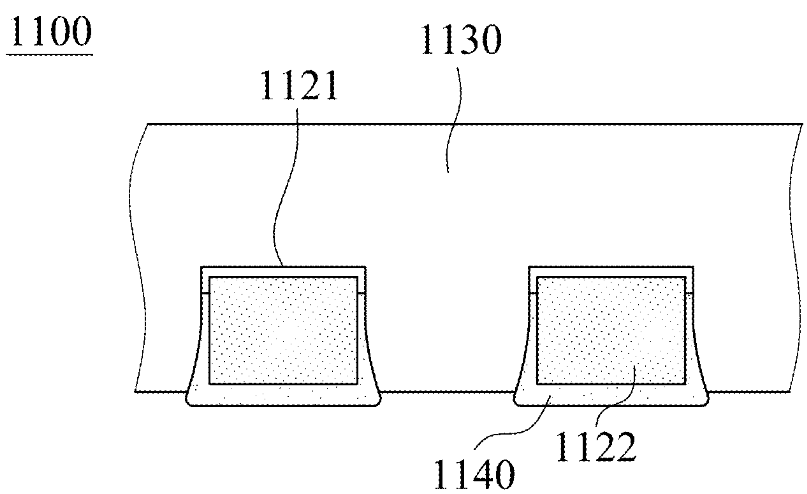

Fig. 71

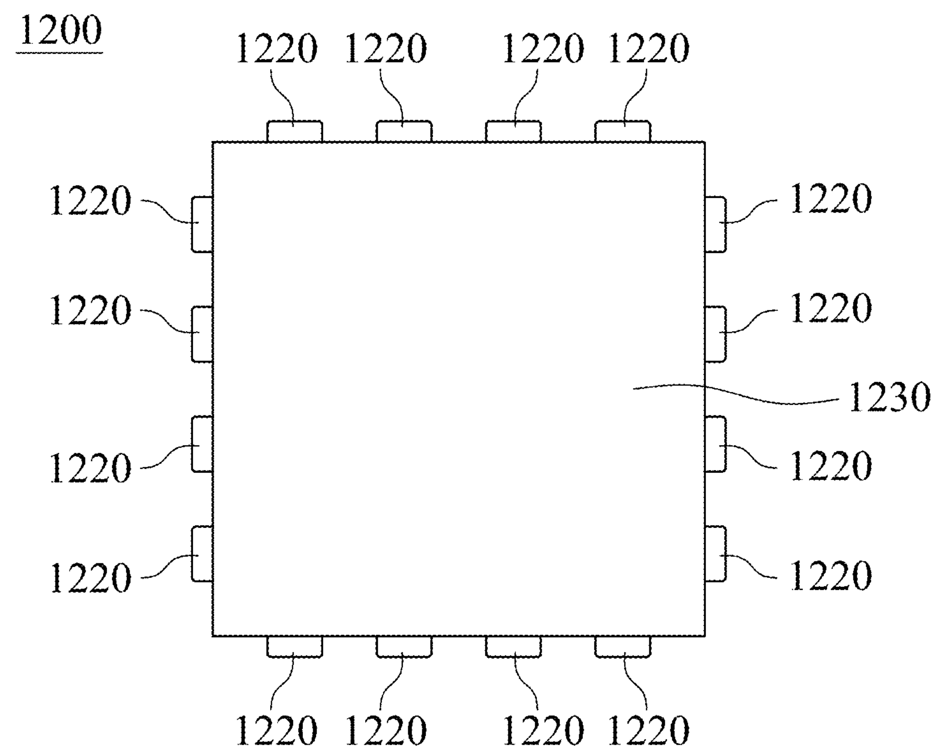
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Fig. 72

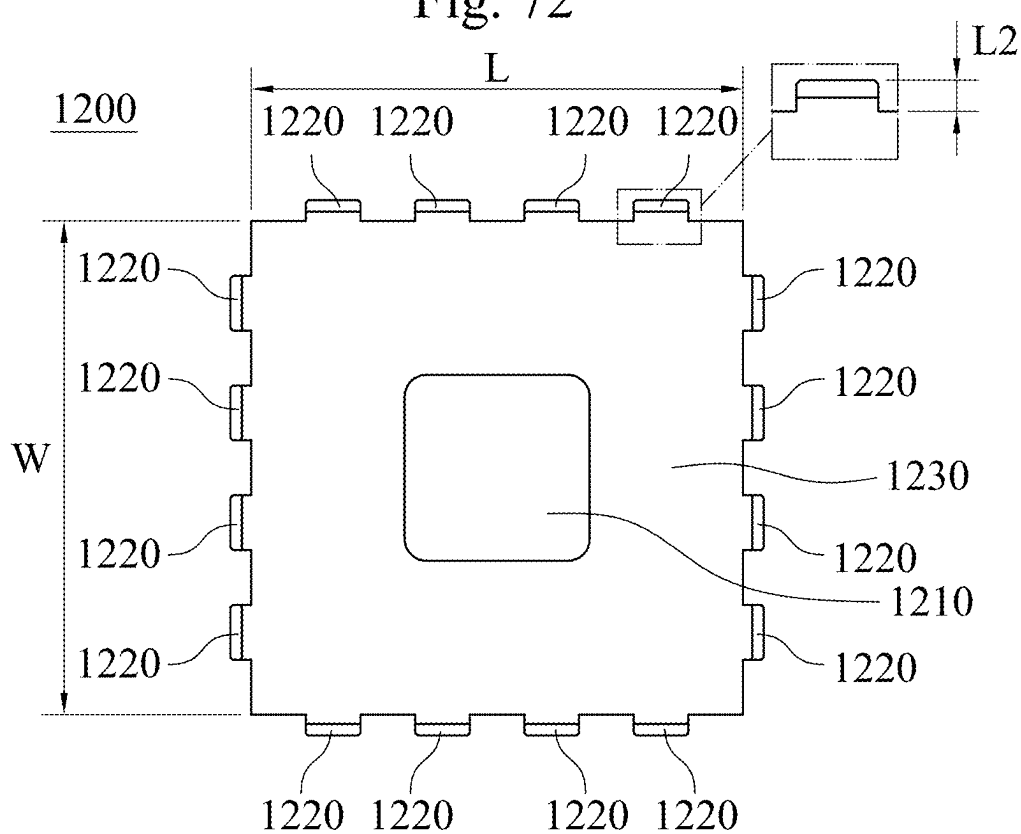
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Fig. 73

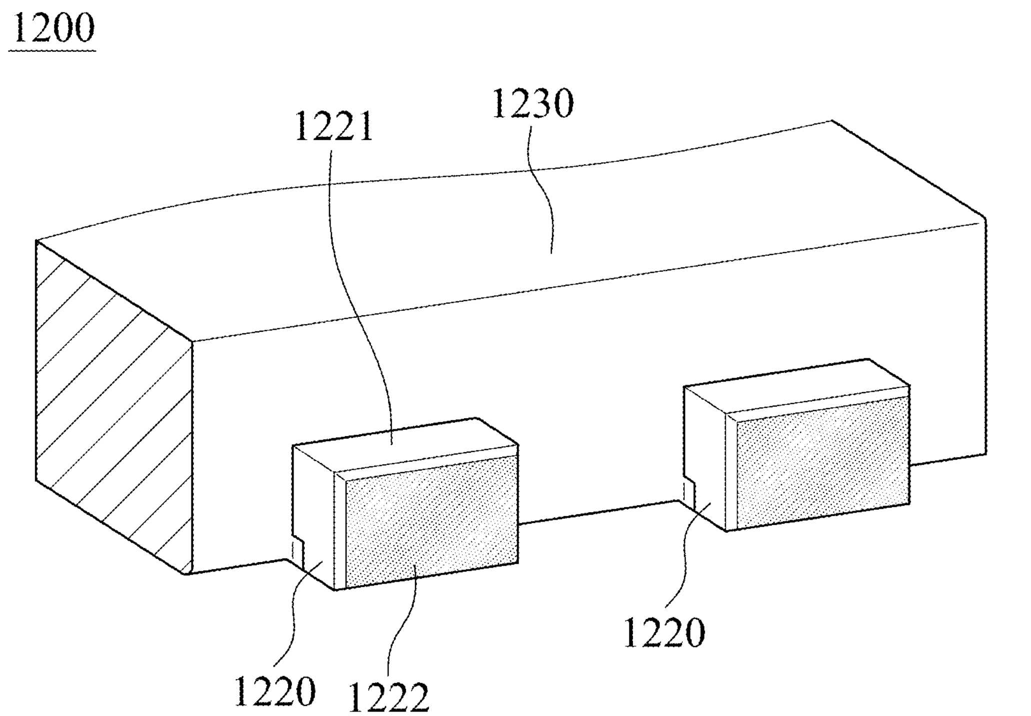

Fig. 74

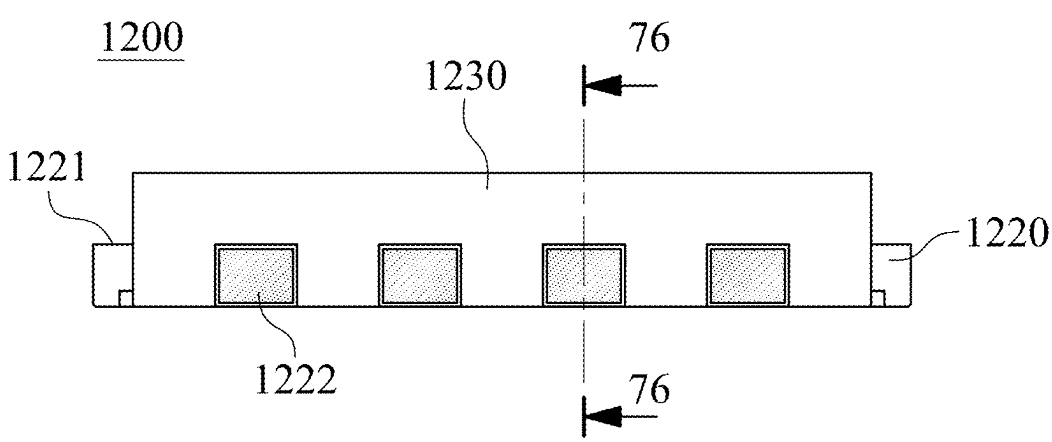

Fig. 75

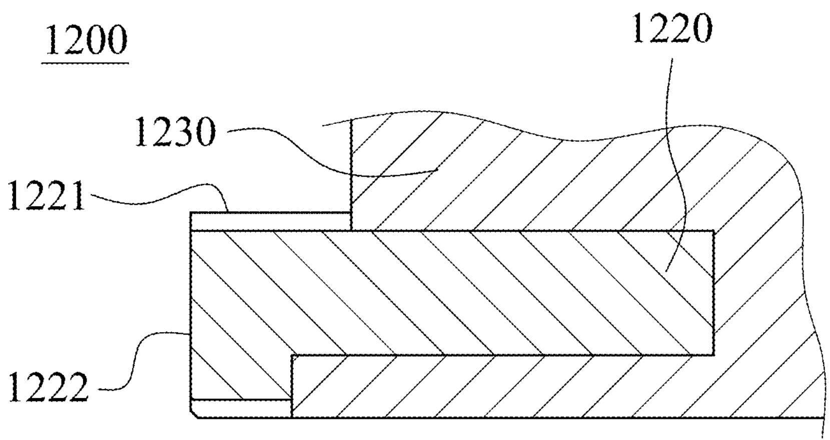

Fig. 76

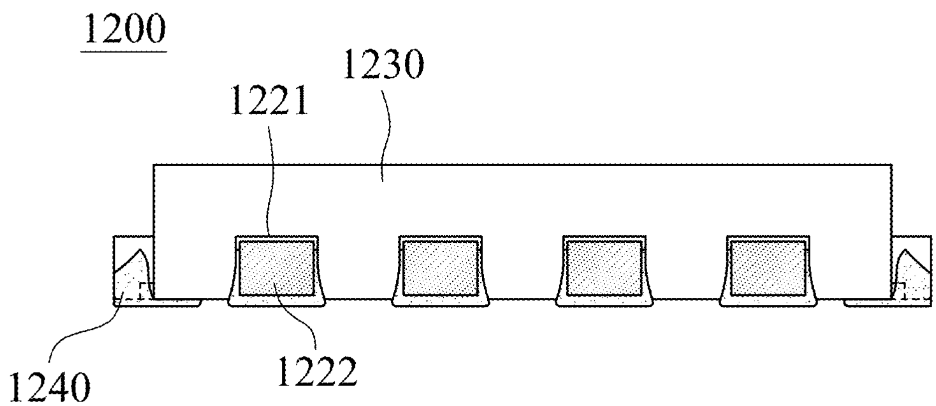

Fig. 77

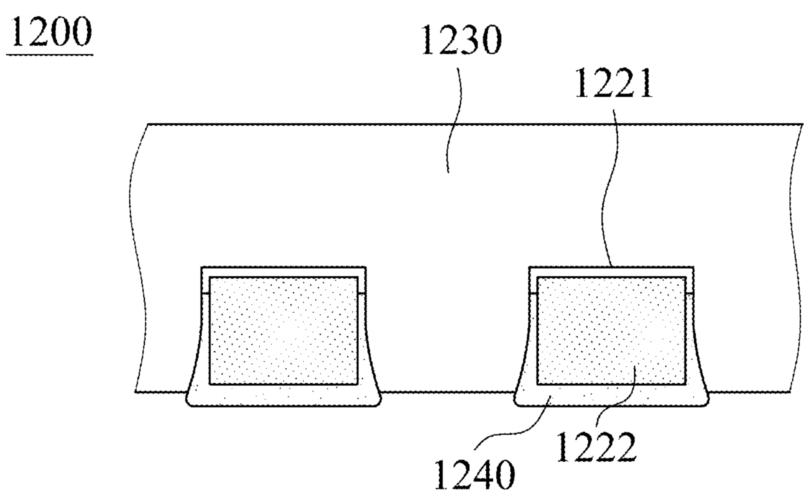

Fig. 78

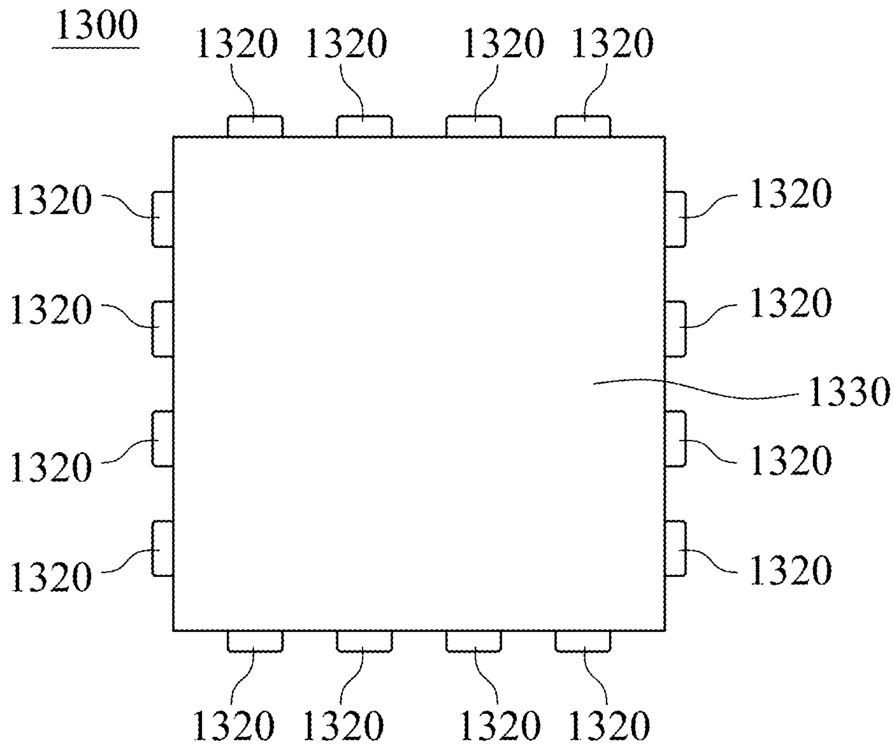
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Fig. 79

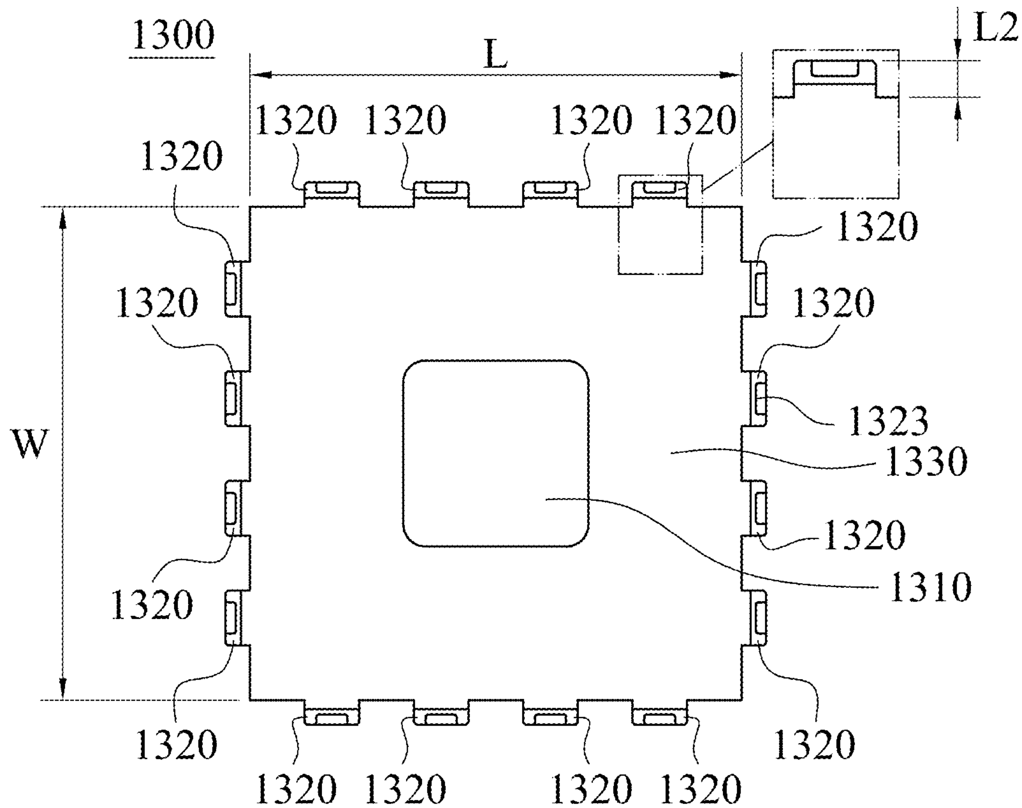
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Fig. 80

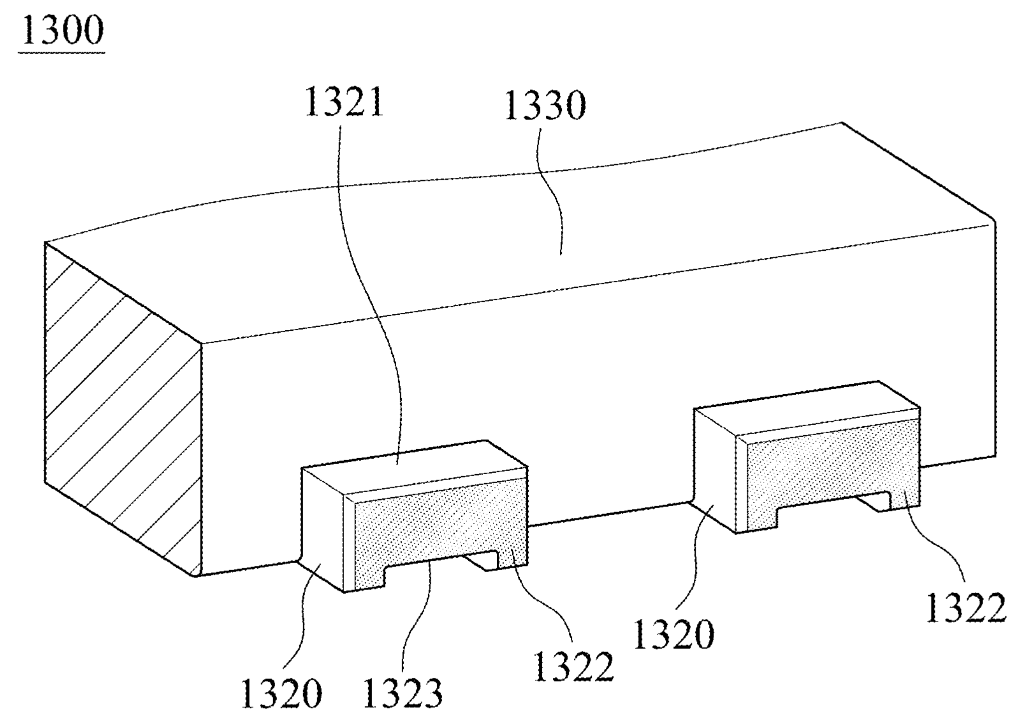
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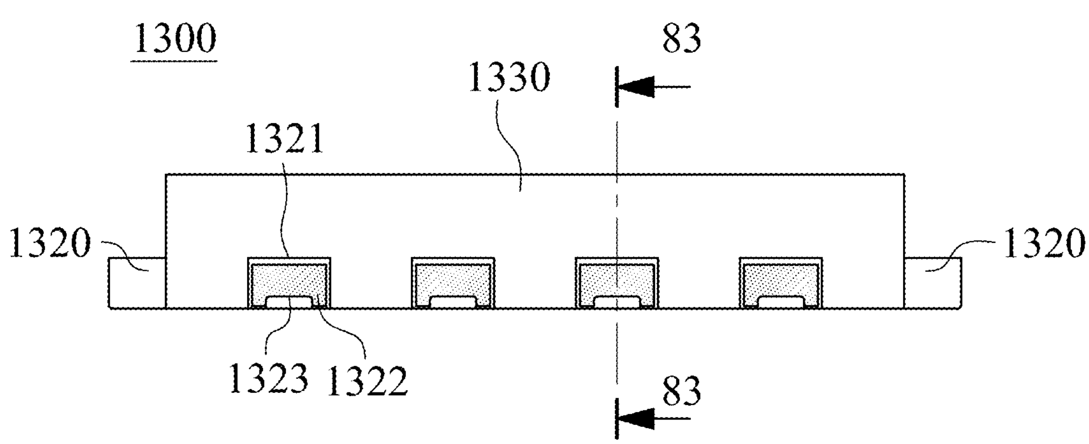
Fig. 81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83

Fig. 82

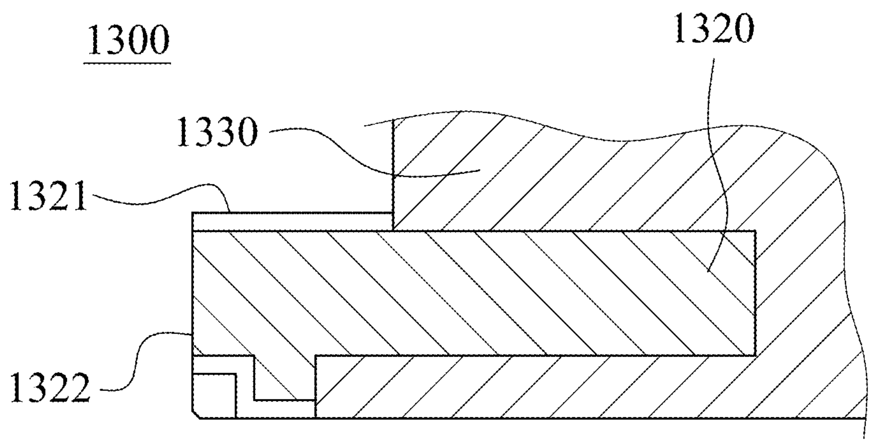

Fig. 83

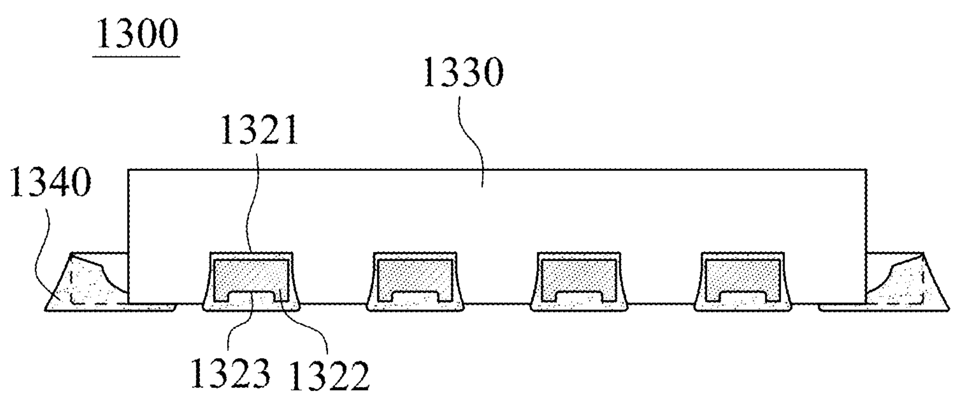

Fig. 84

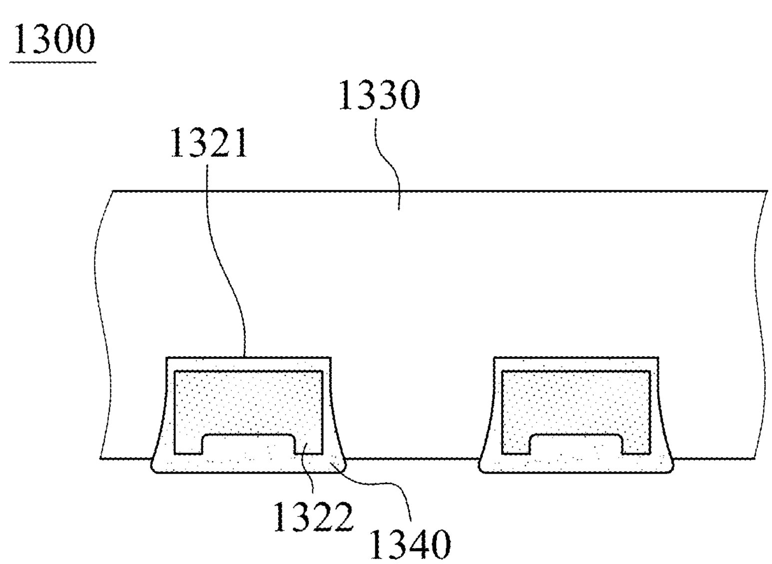

Fig. 85

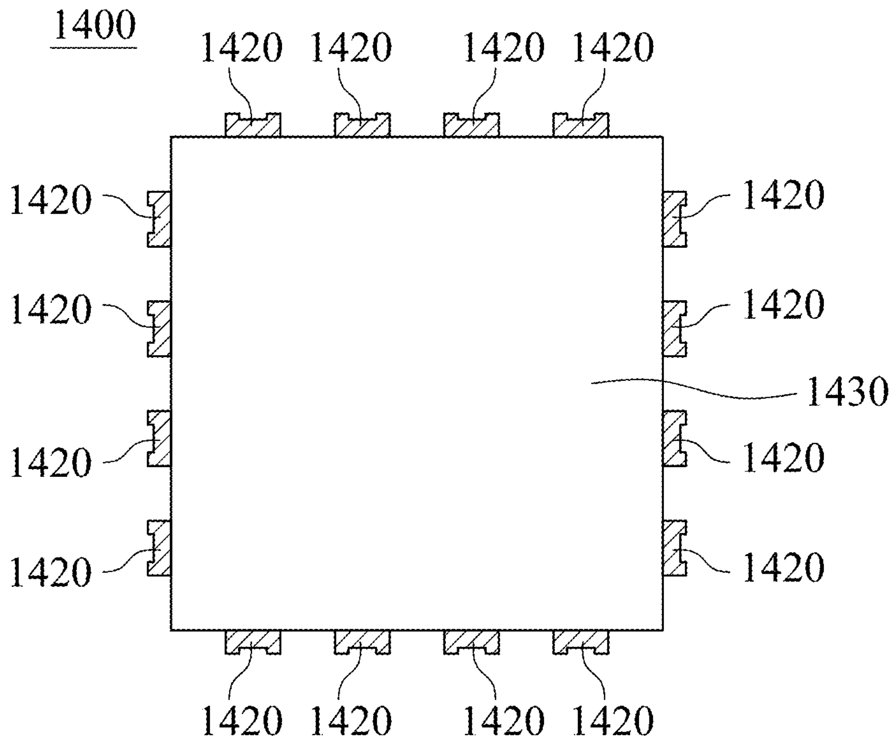

Fig. 86

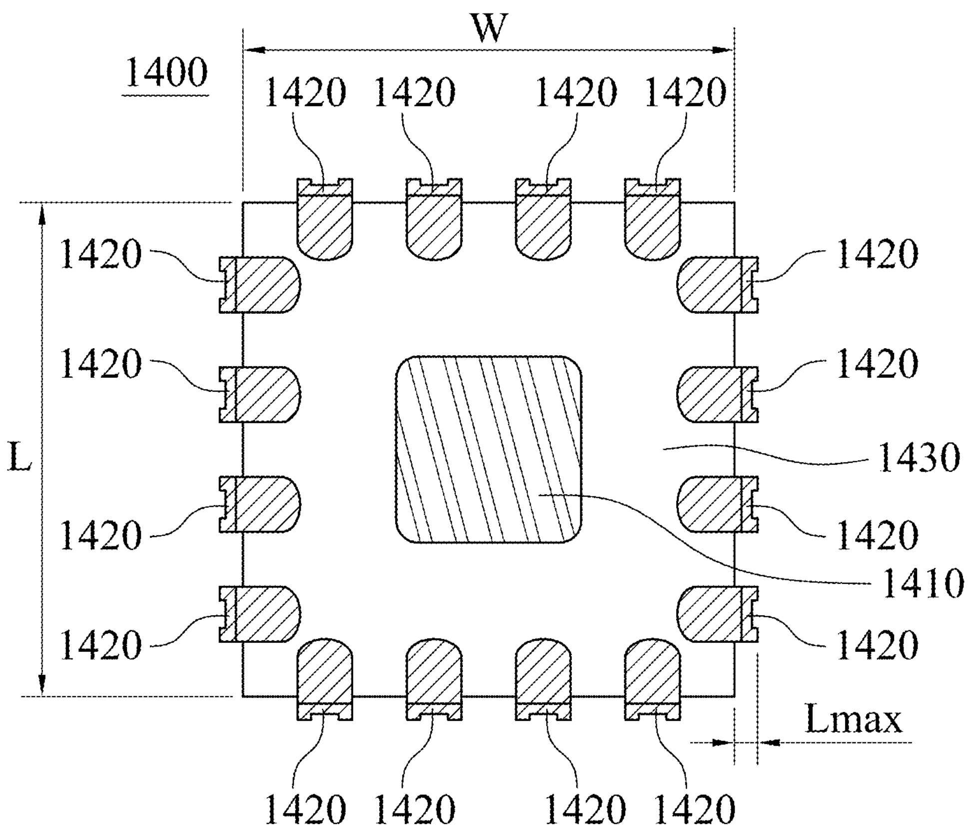

Fig. 87

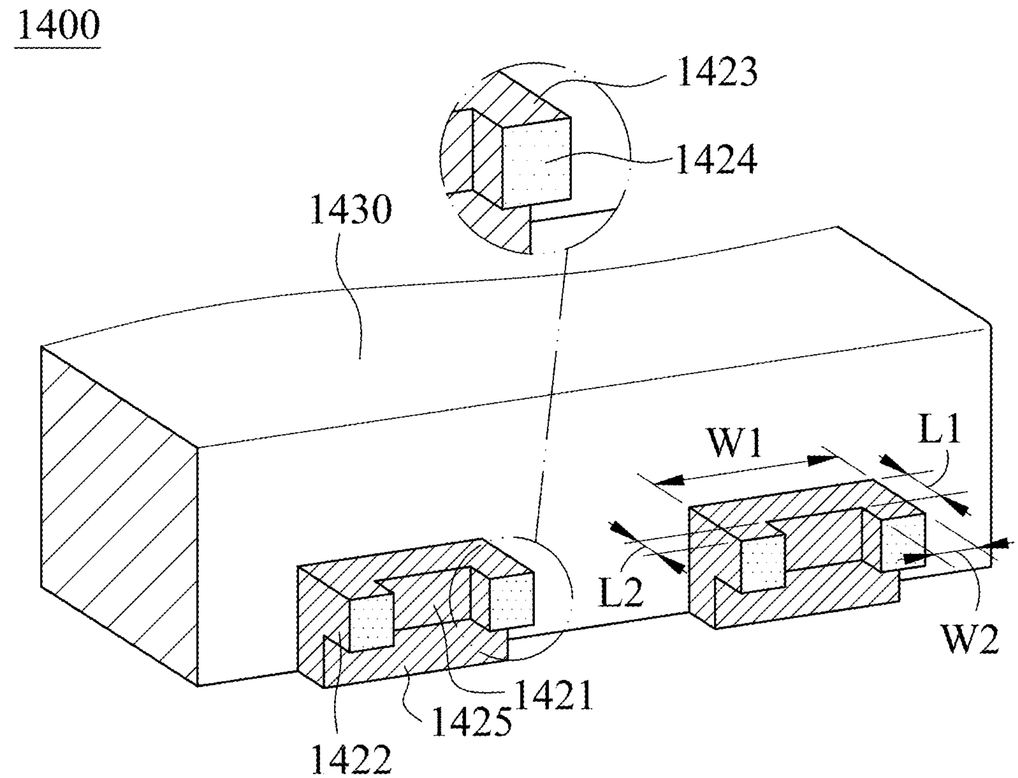
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Fig. 88

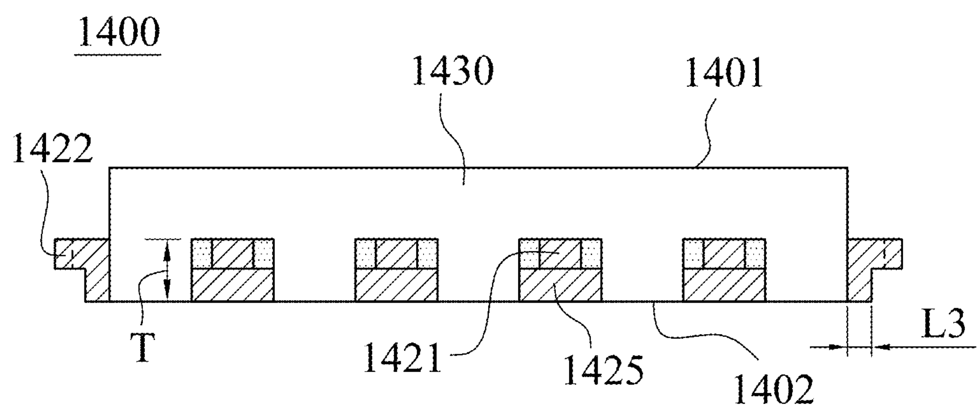
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Fig. 89

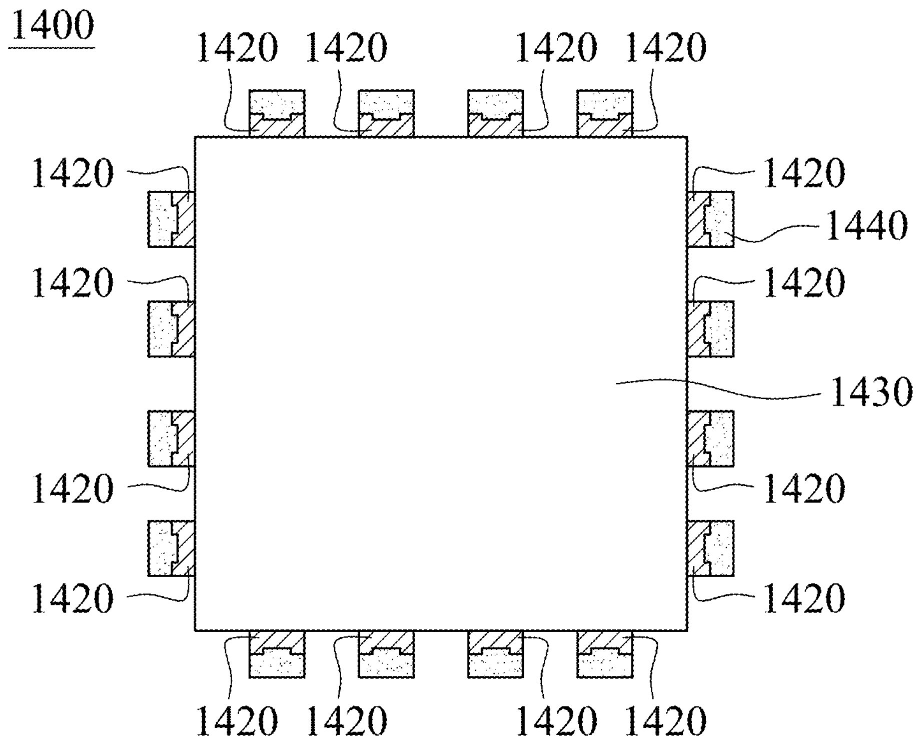
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Fig. 90

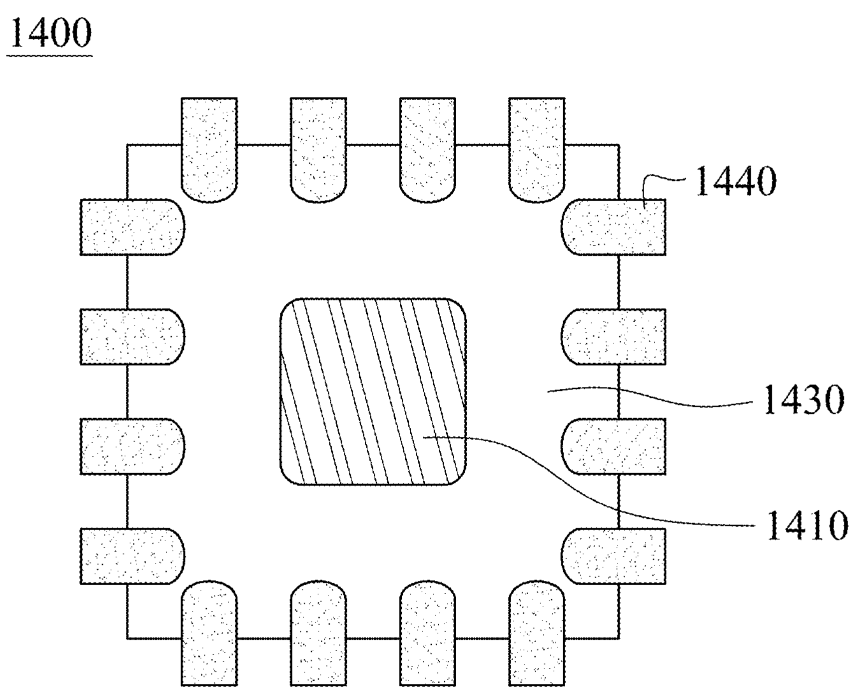
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Fig. 91

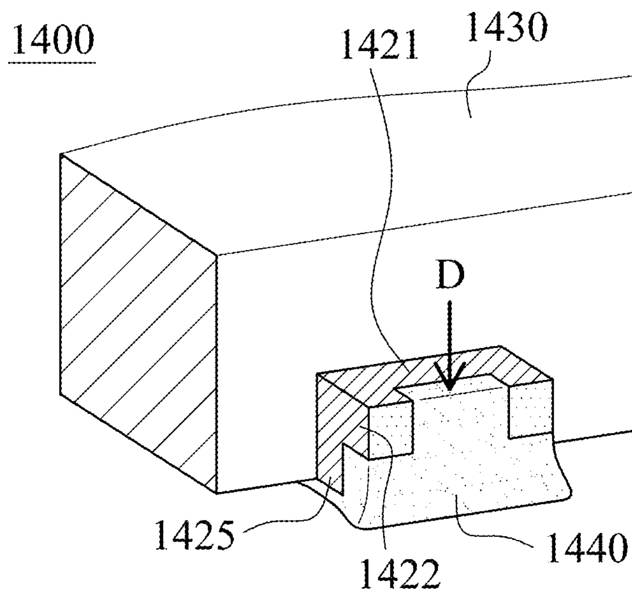

Fig. 92

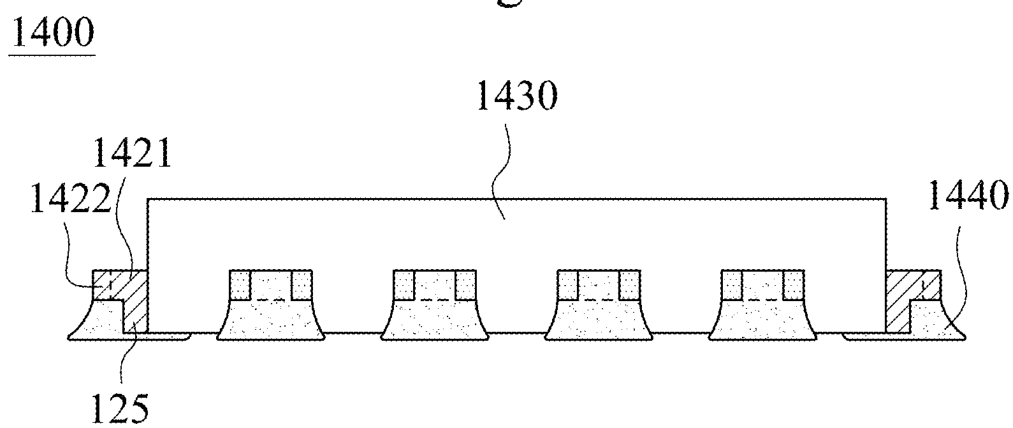

Fig. 93

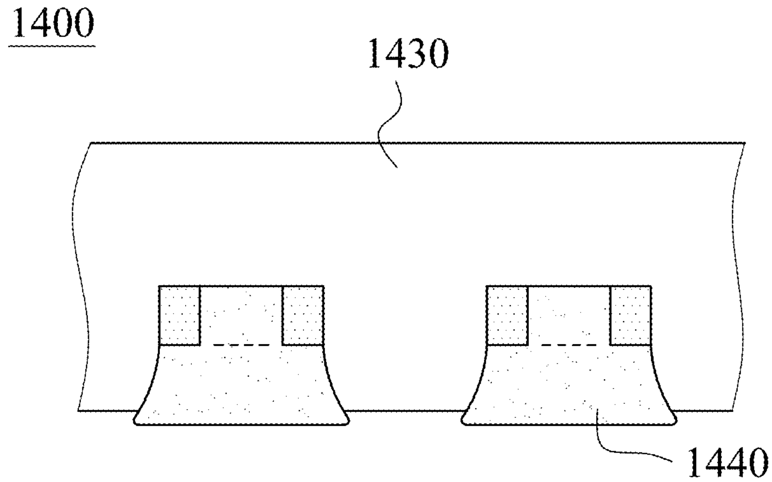

Fig. 94

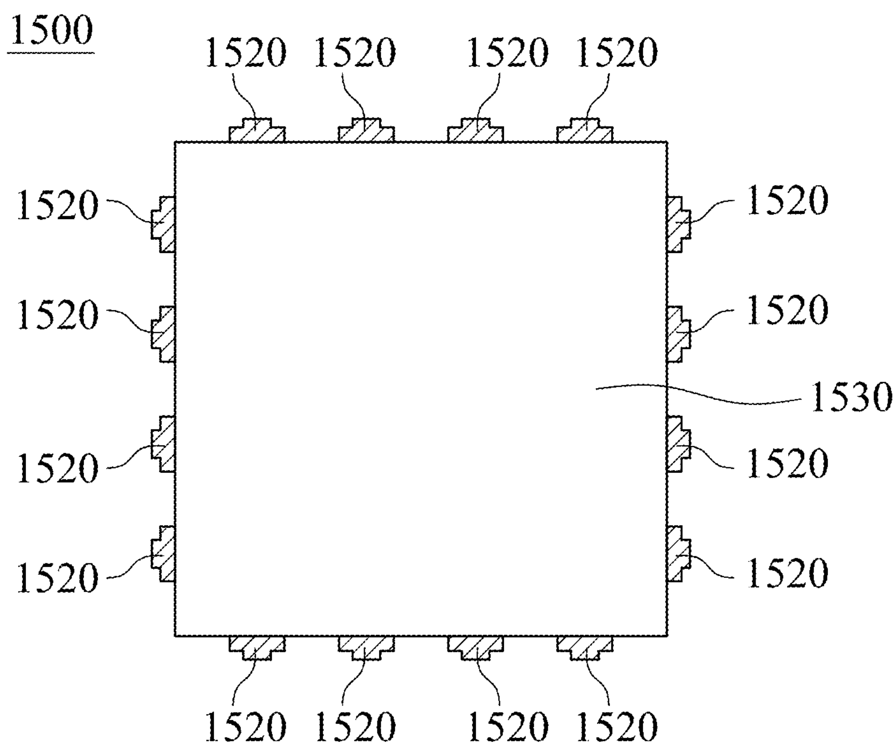
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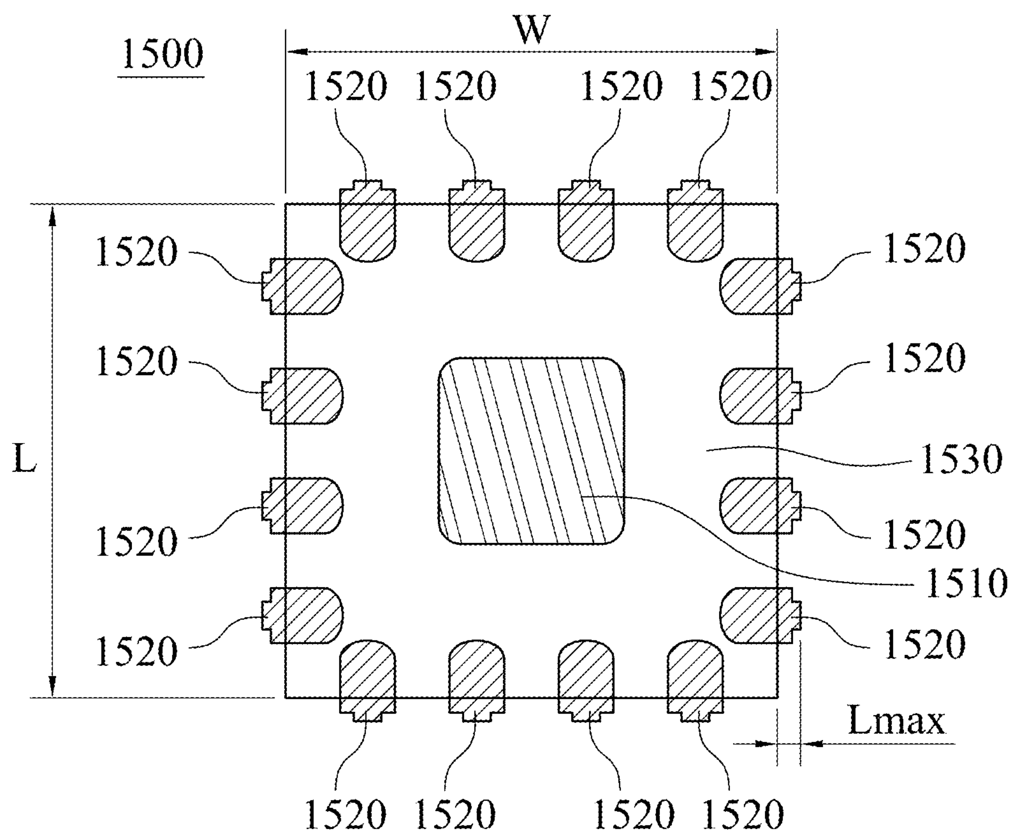
Fig. 95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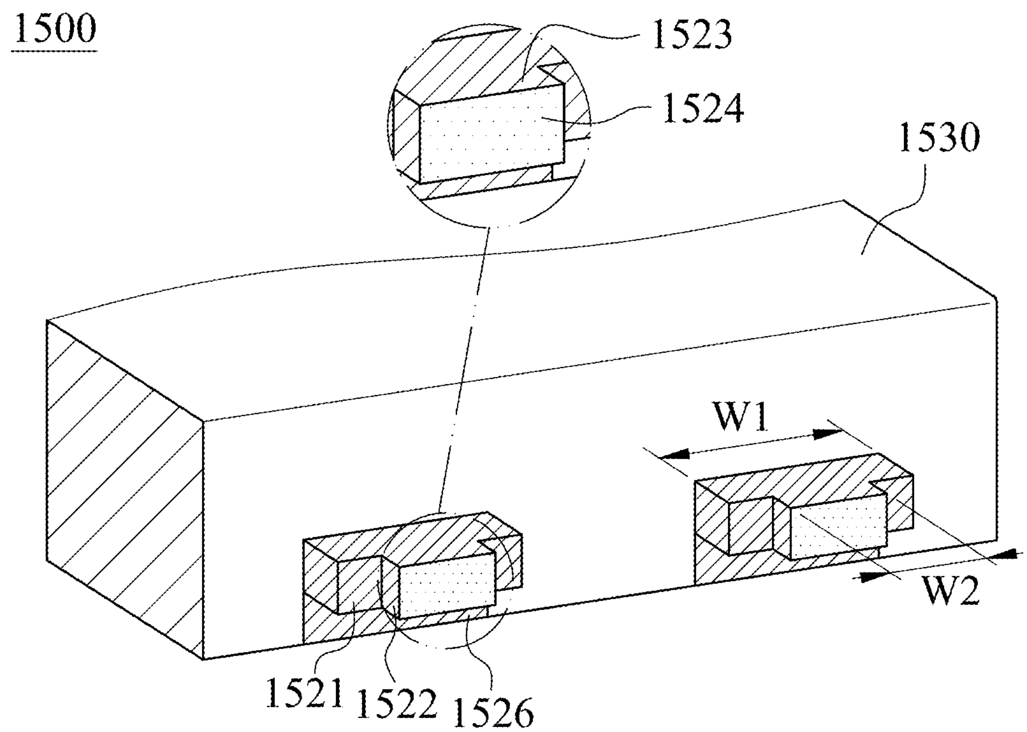
Lmax

Fig. 96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W1
W2
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1526

Fig. 97

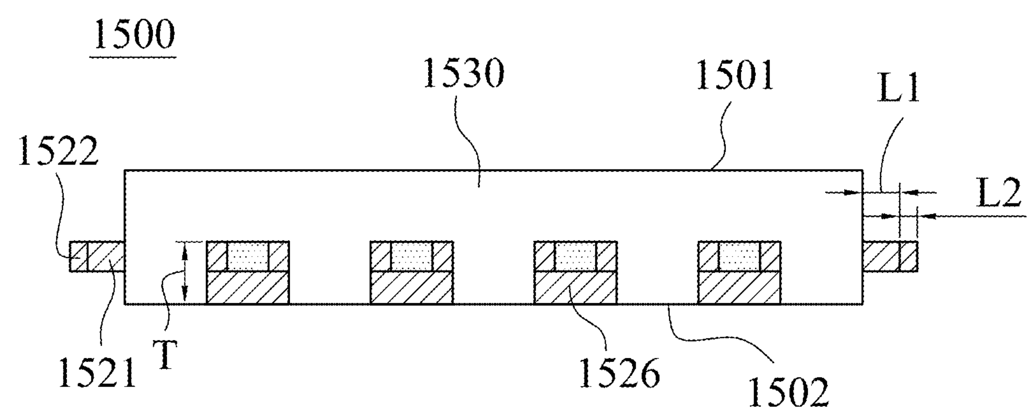

1500
1530
1501
L1
L2
1522
1521
T
1526
1502

Fig. 98

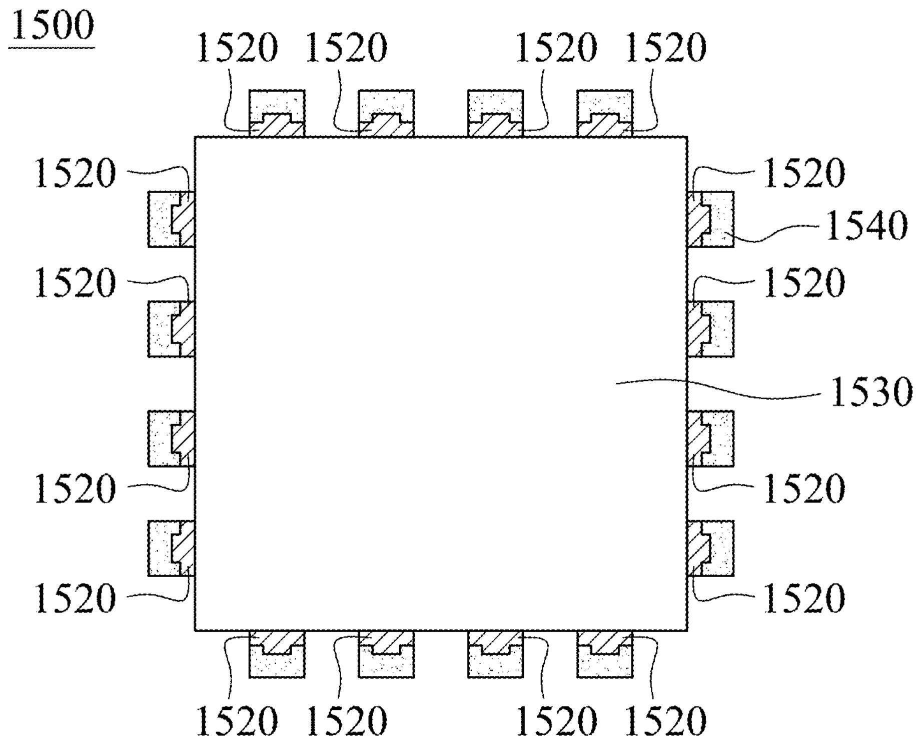


Fig. 99

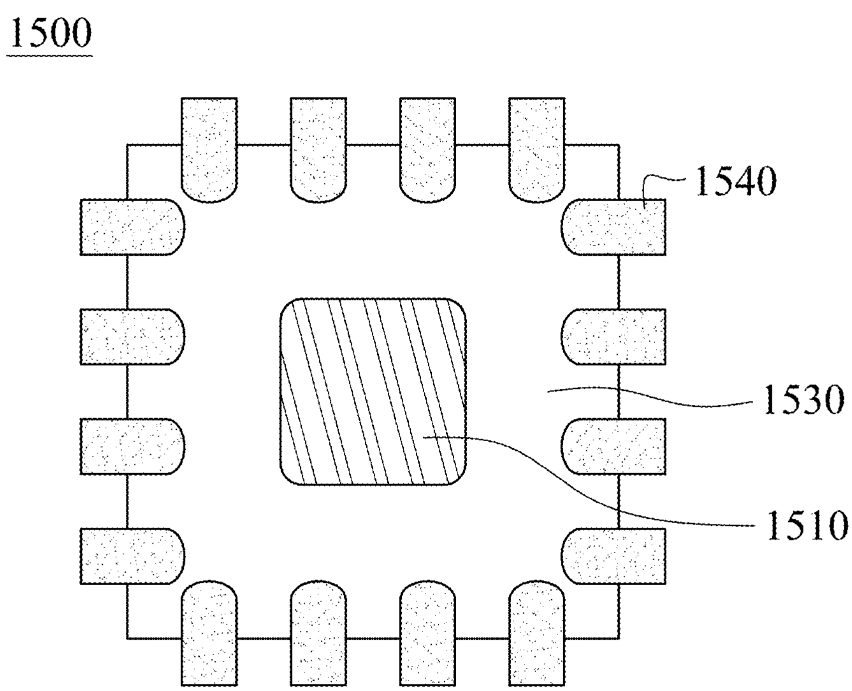


Fig. 100

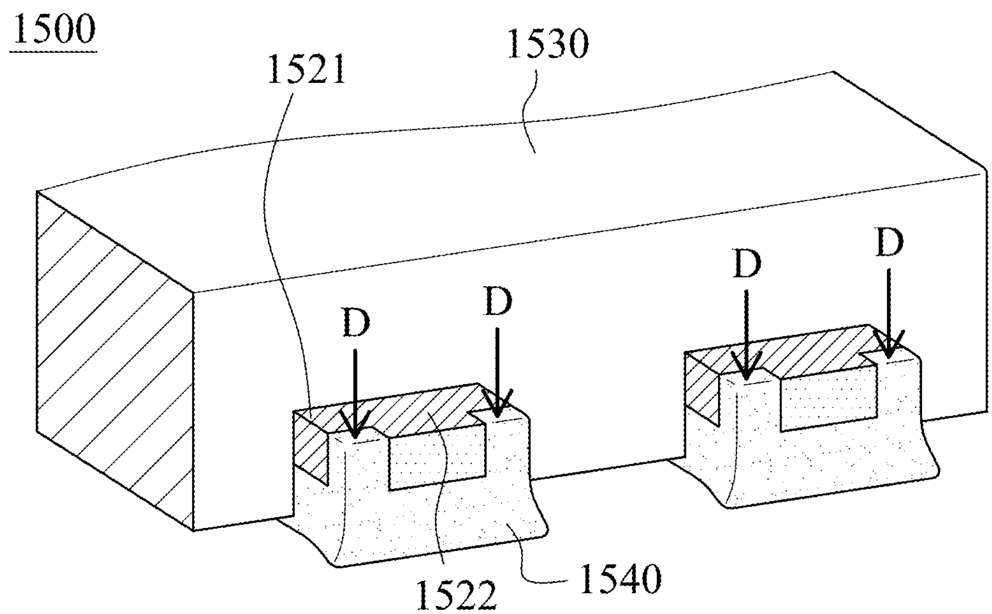


Fig. 101

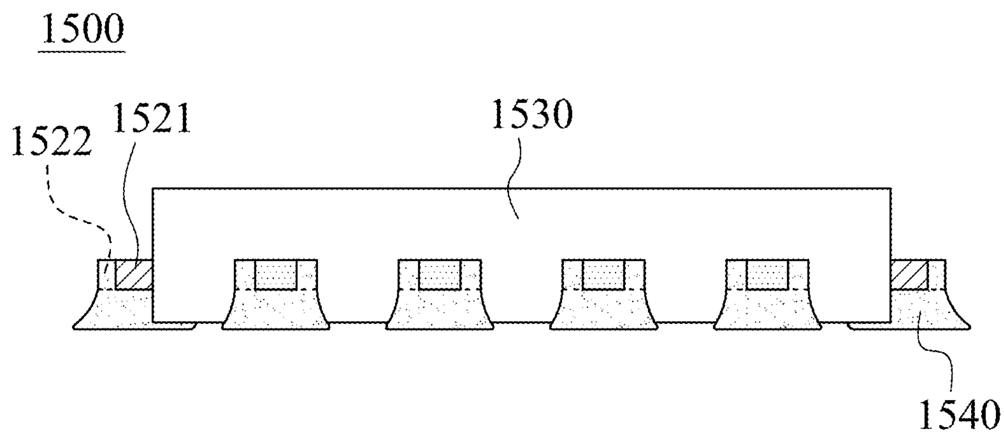


Fig. 102

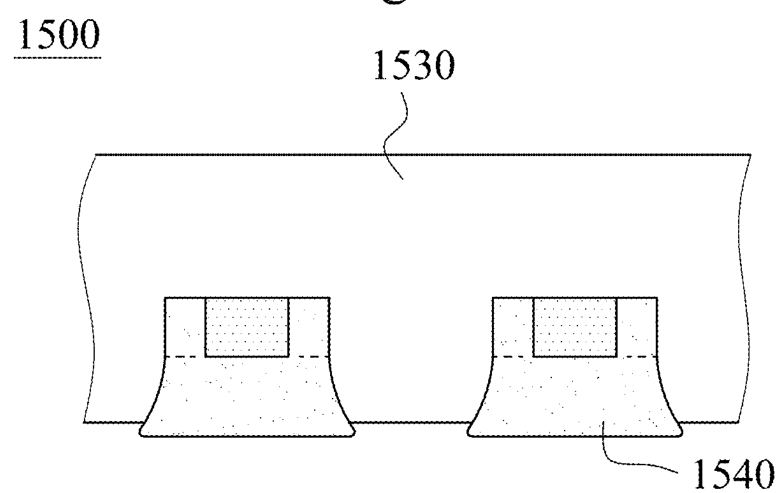


Fig. 103

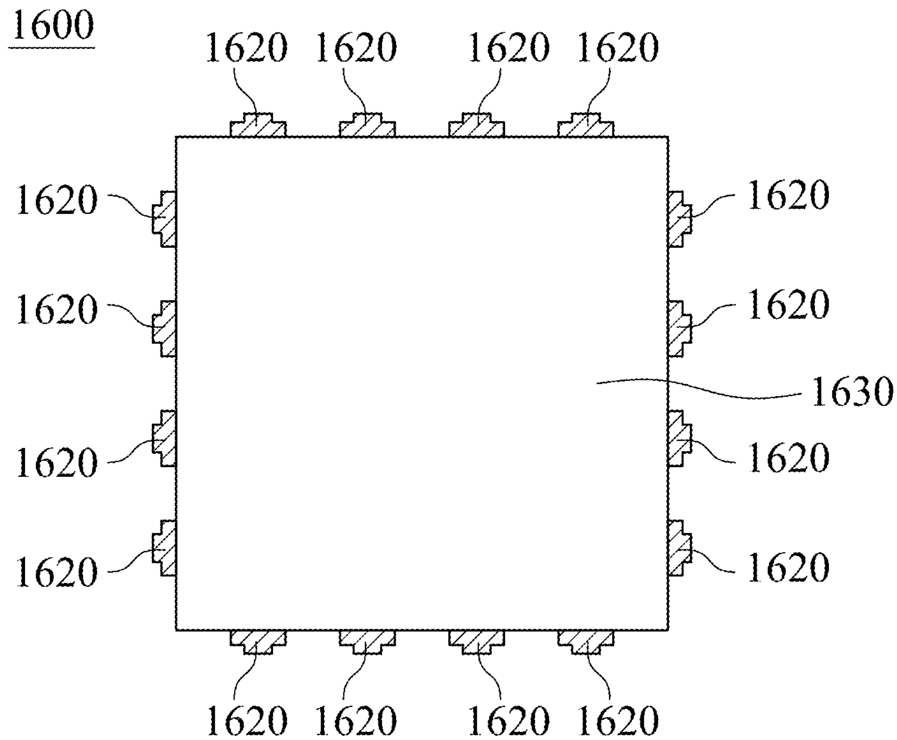


Fig. 104

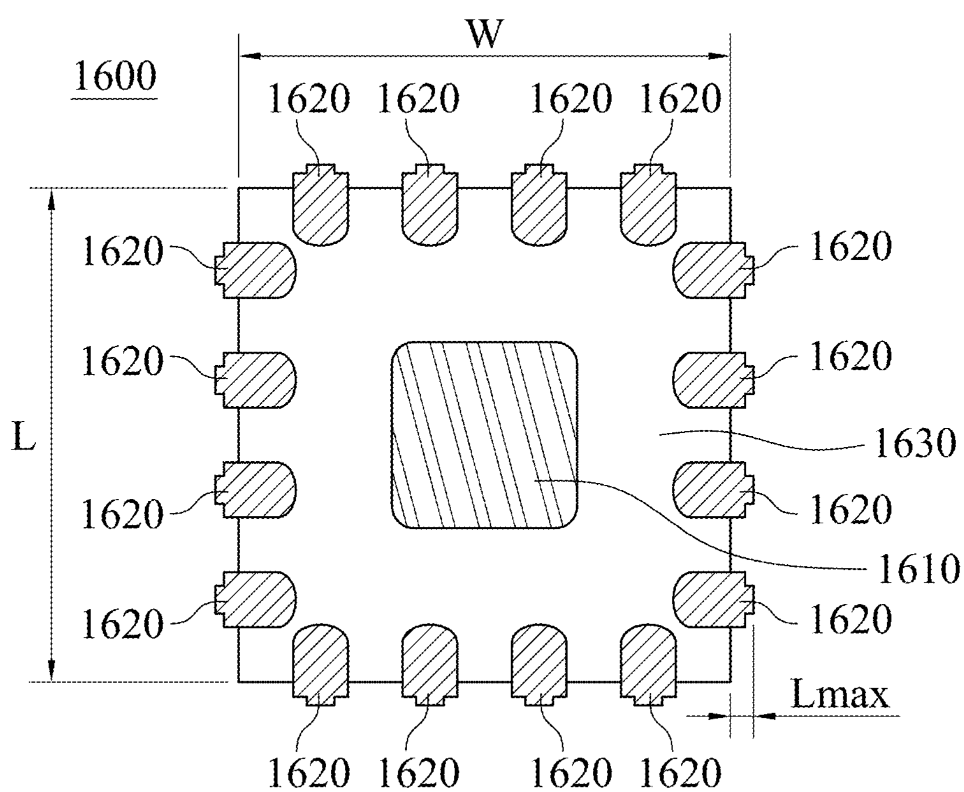


Fig. 105

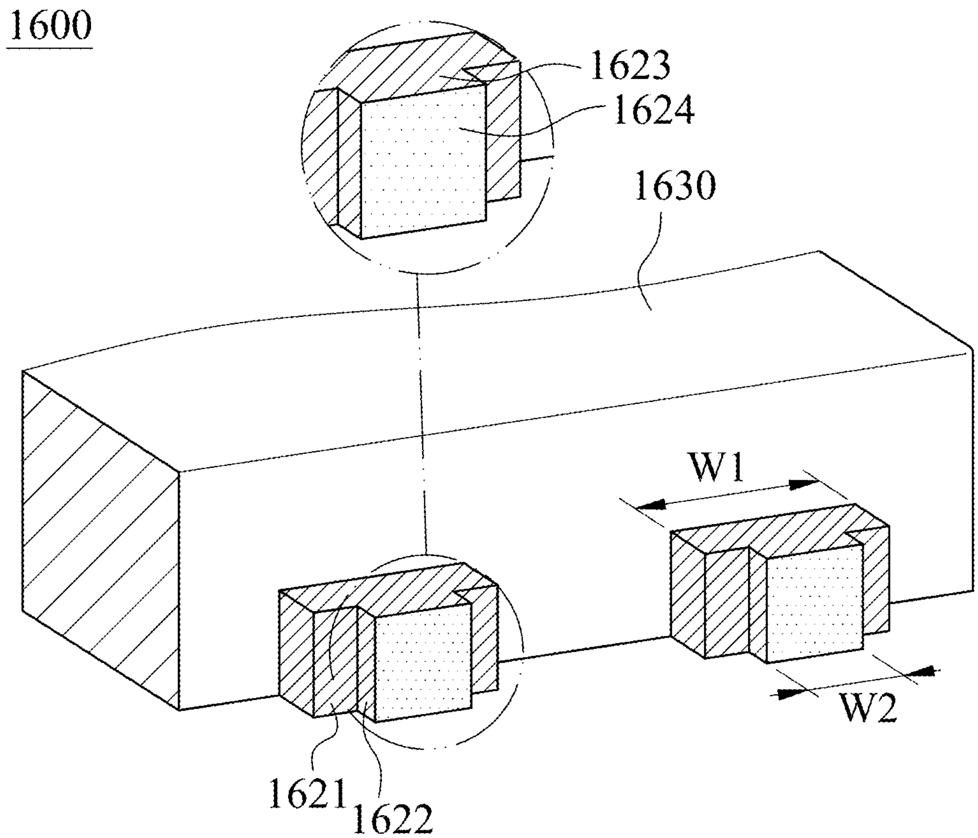


Fig. 106

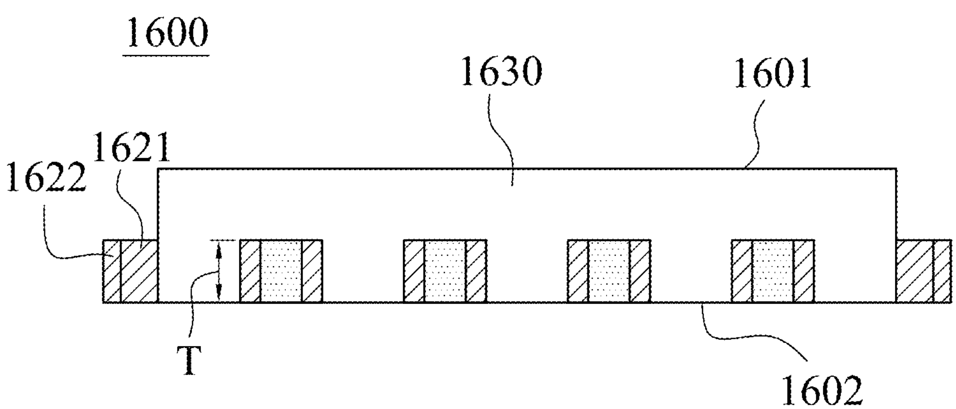


Fig. 107

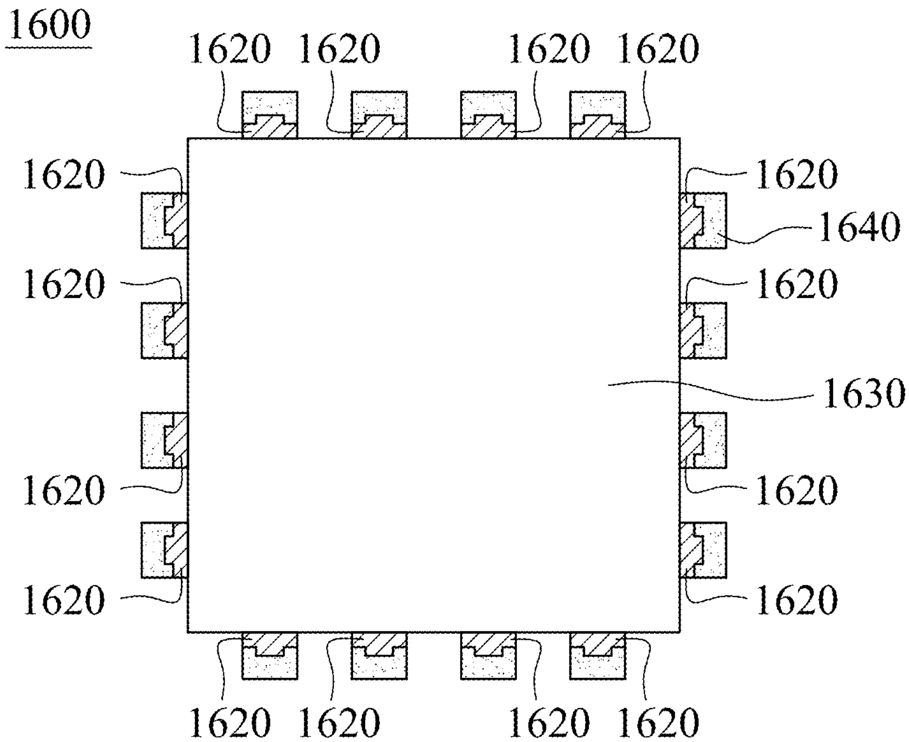


Fig. 108

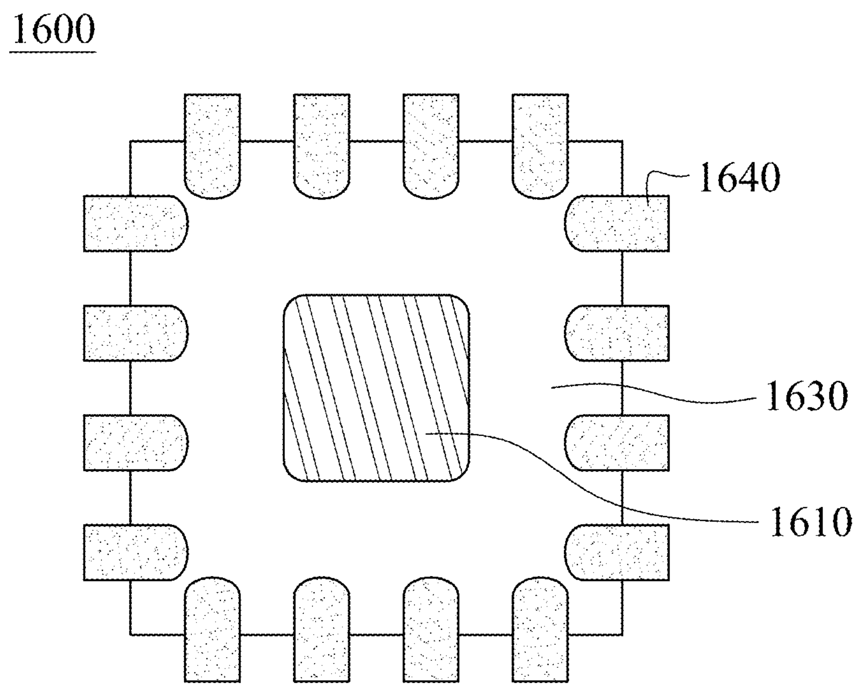


Fig. 109

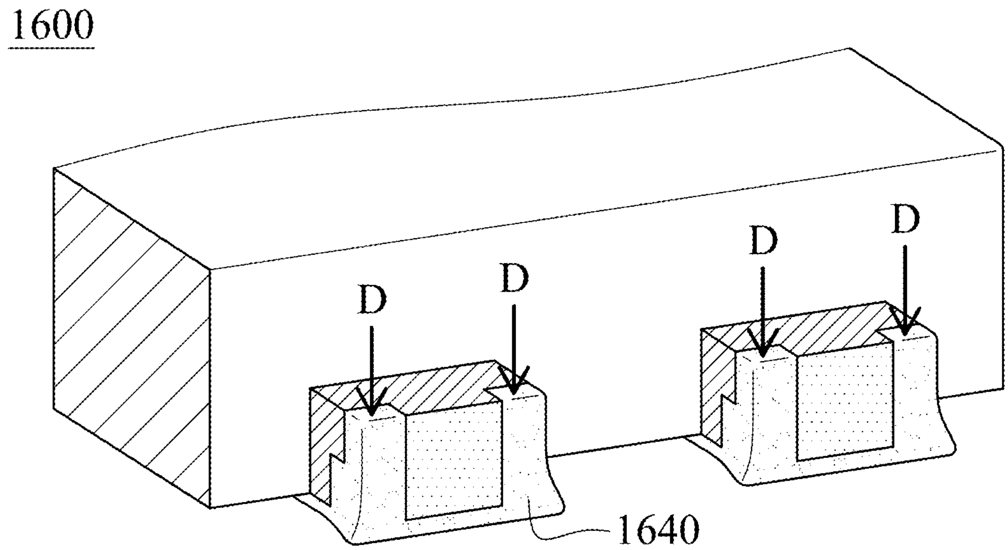


Fig. 110

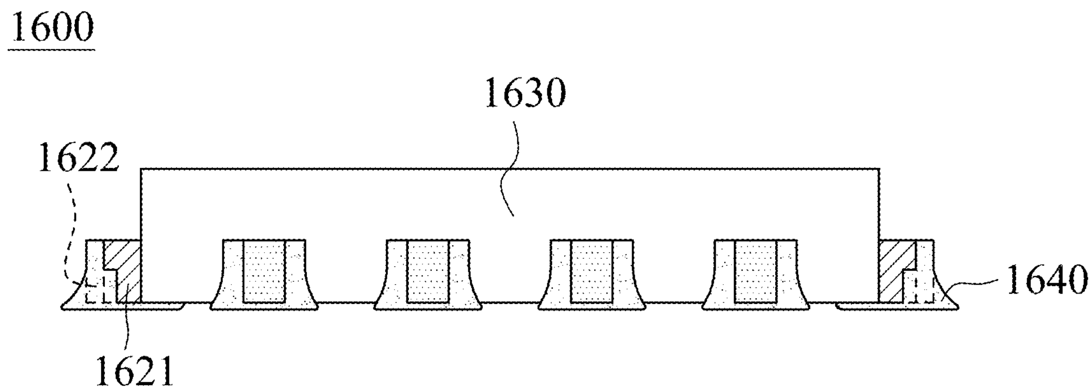


Fig. 111

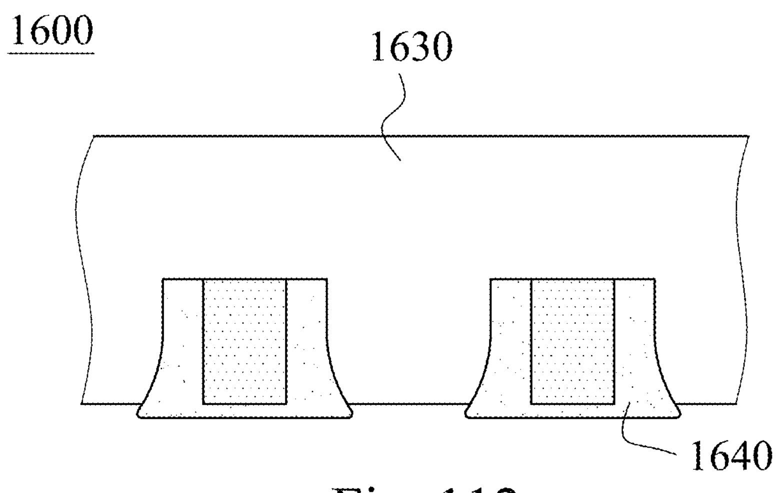


Fig. 112

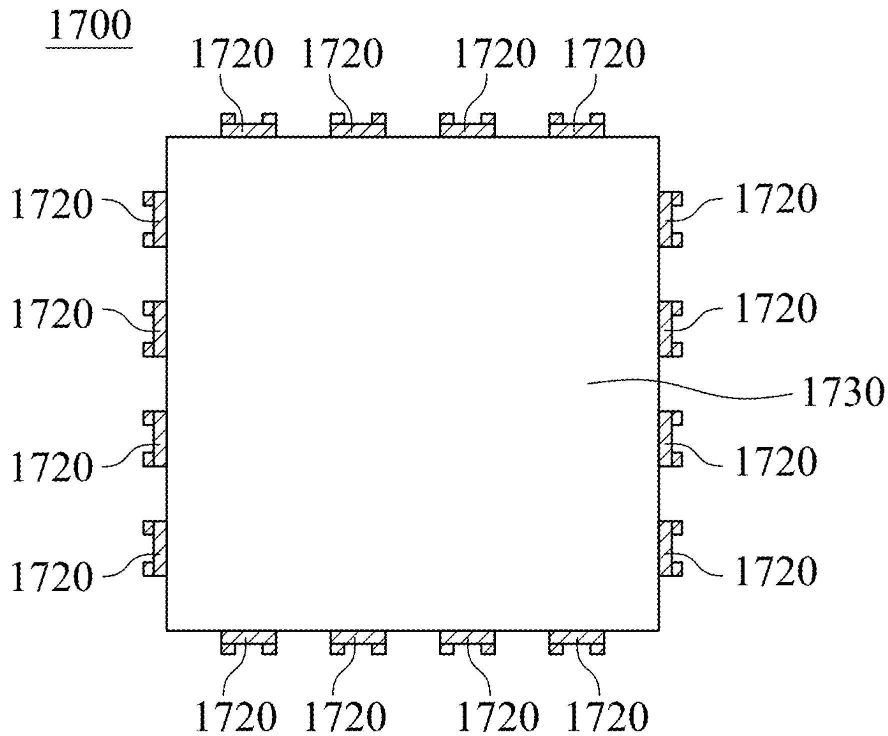


Fig. 113

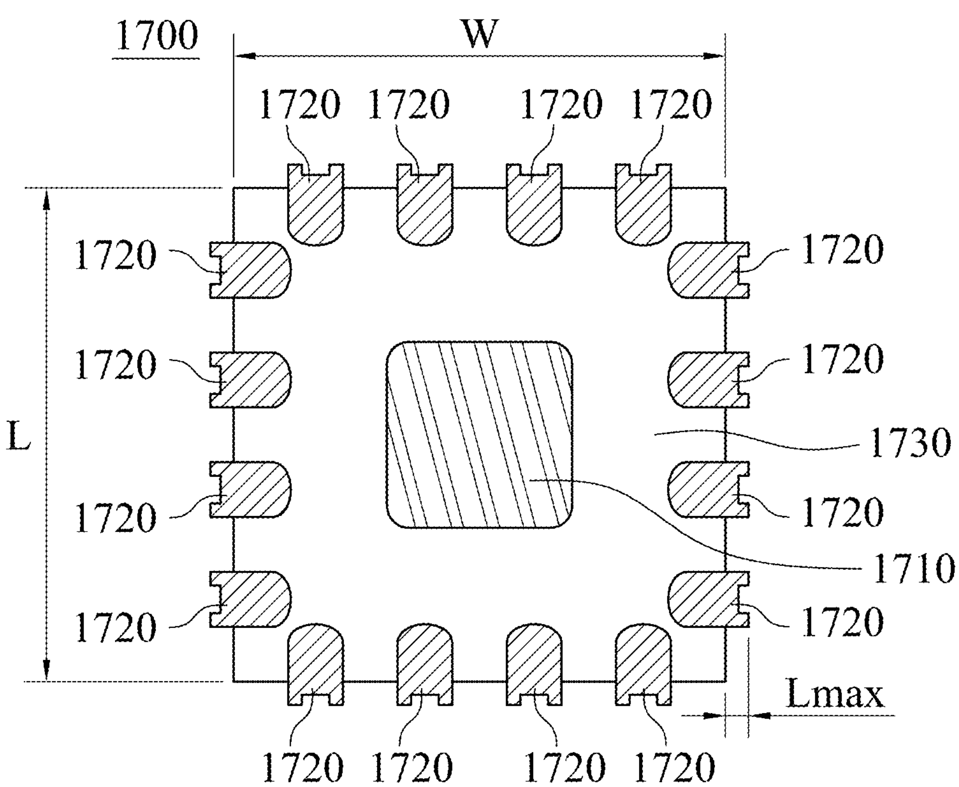


Fig. 114

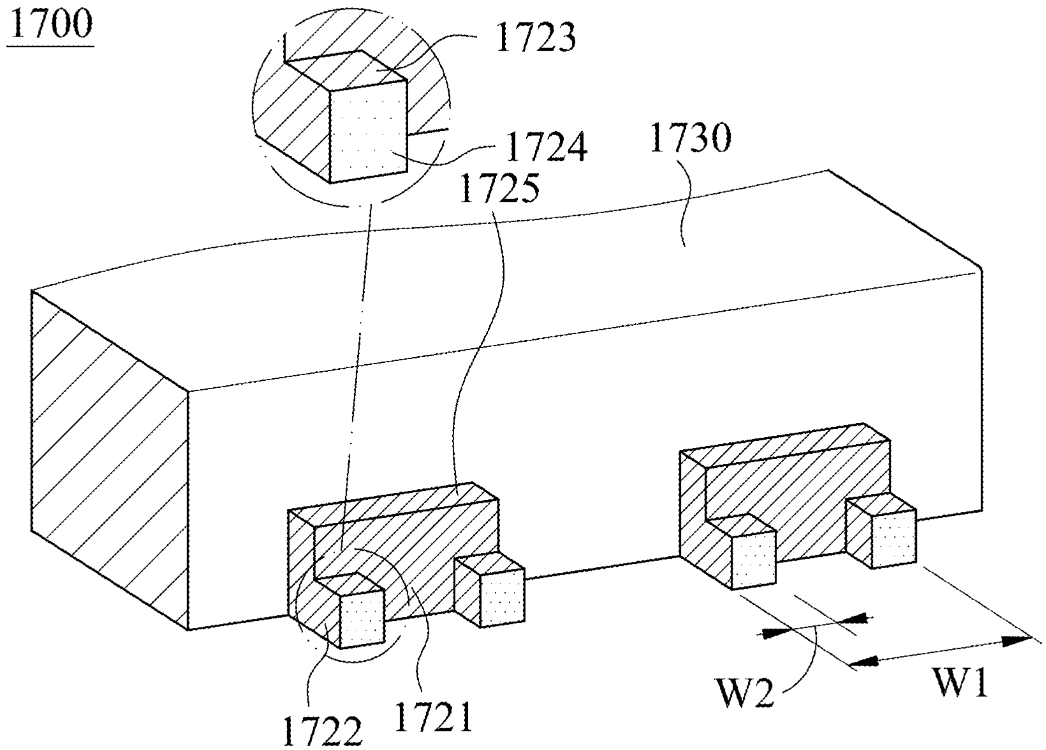


Fig. 115

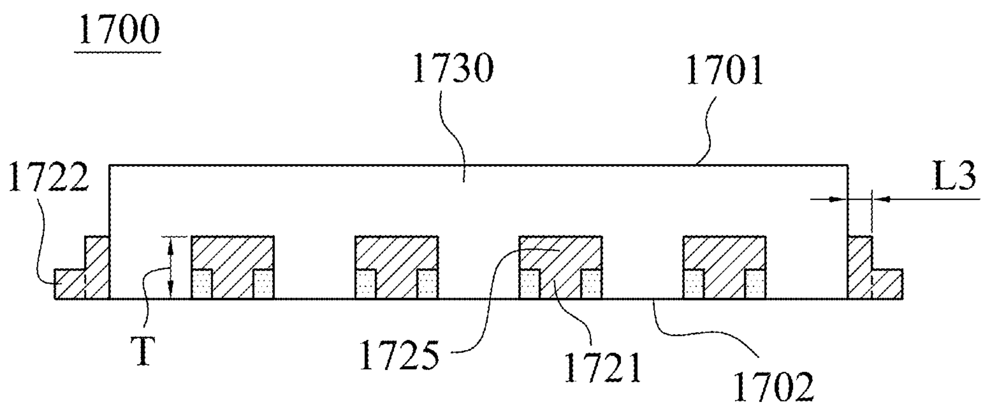


Fig. 116

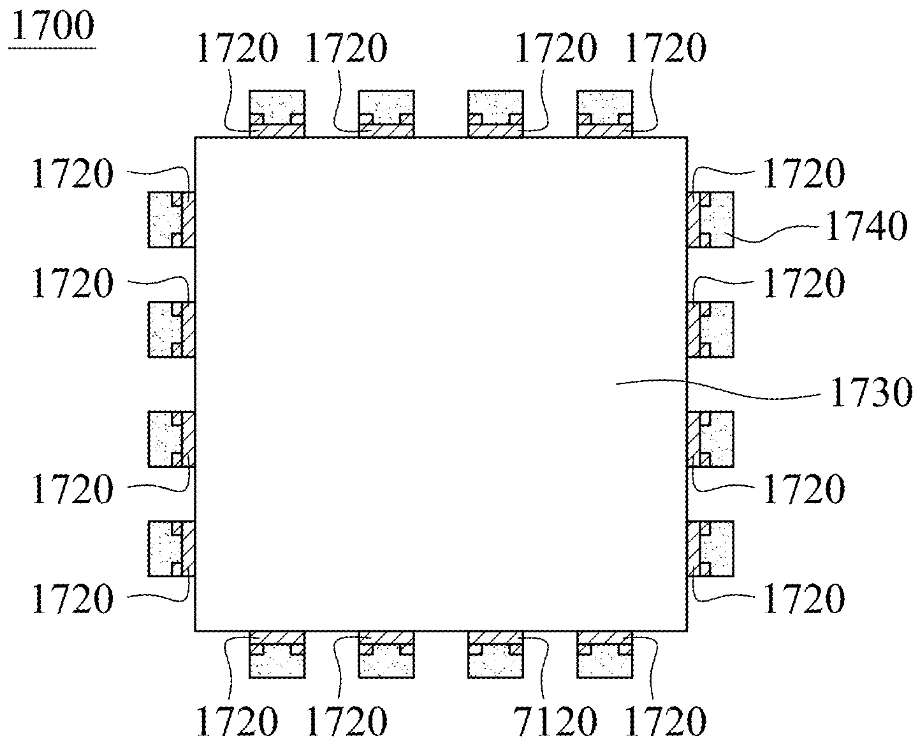
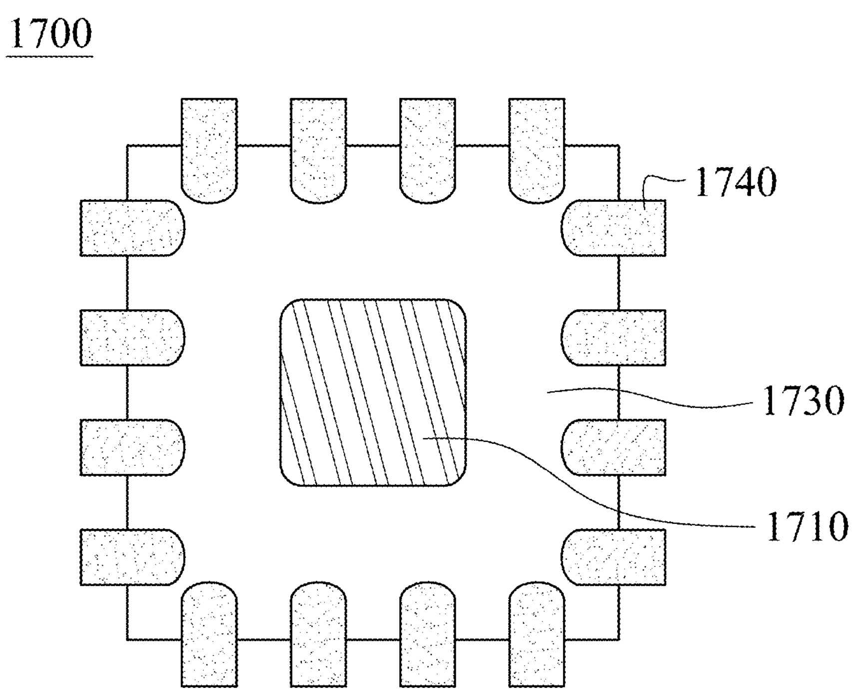


Fig. 117



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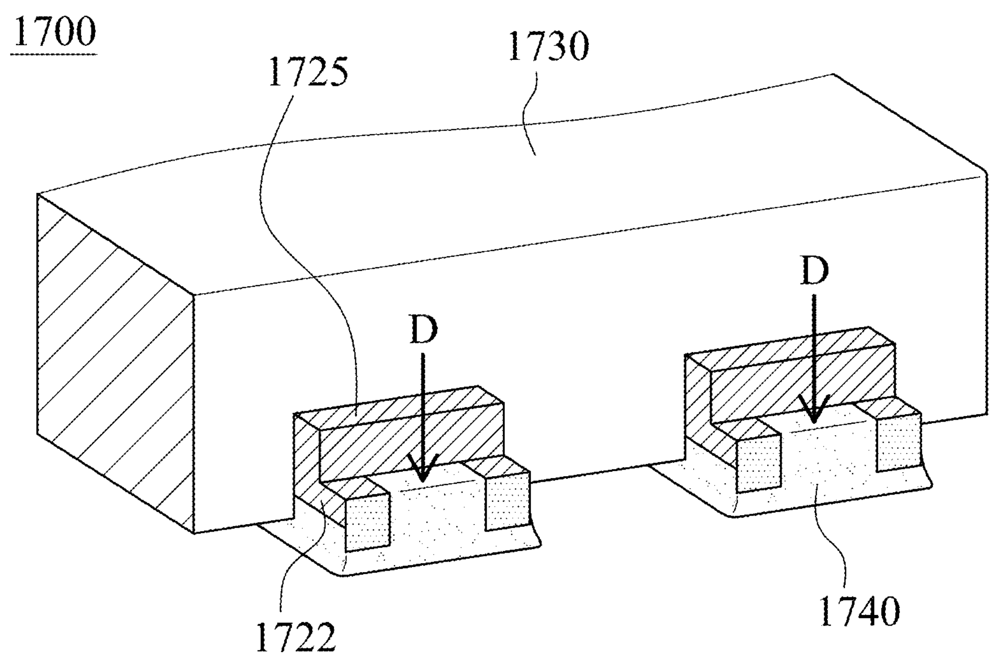

Fig. 119

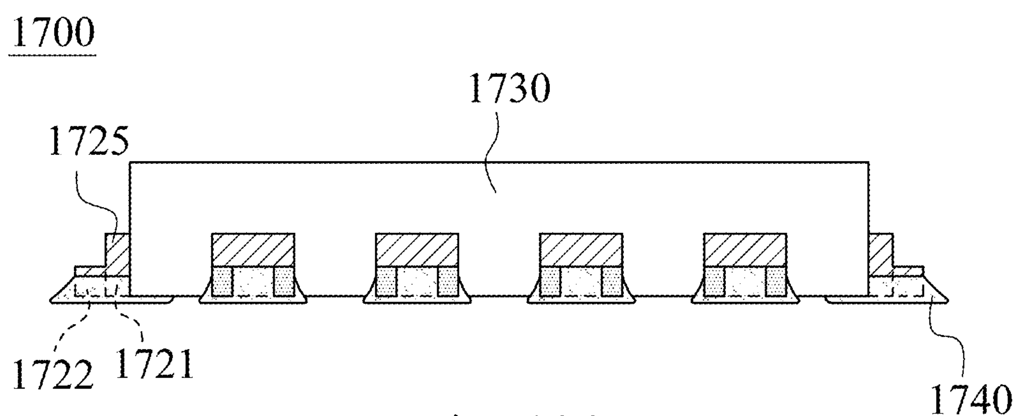

Fig. 120

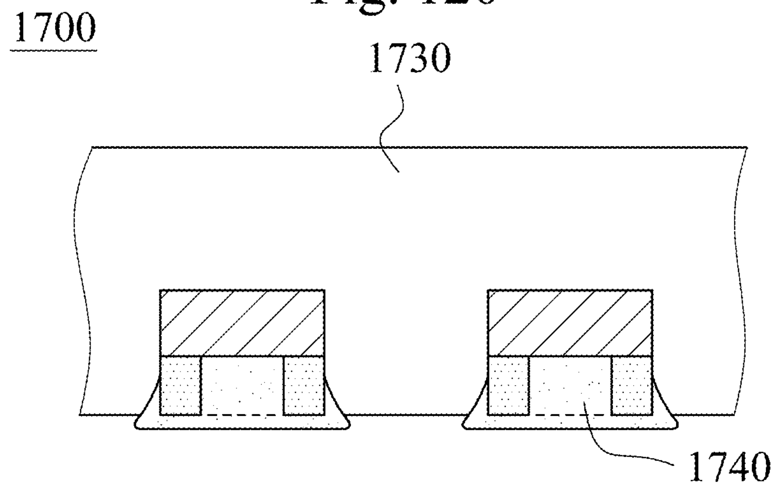

Fig. 121

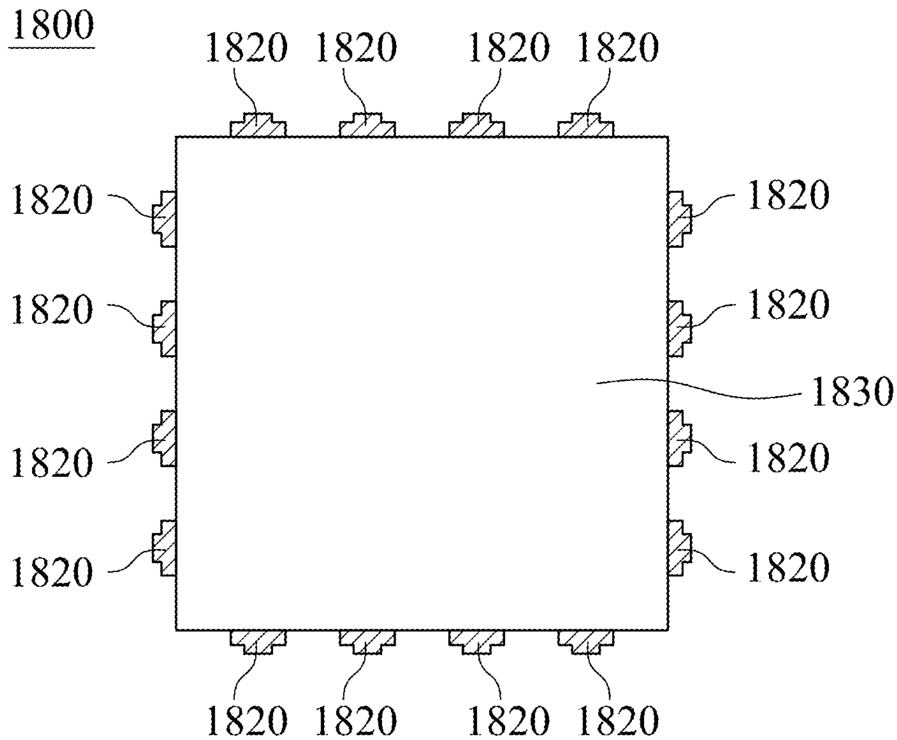

Fig. 122

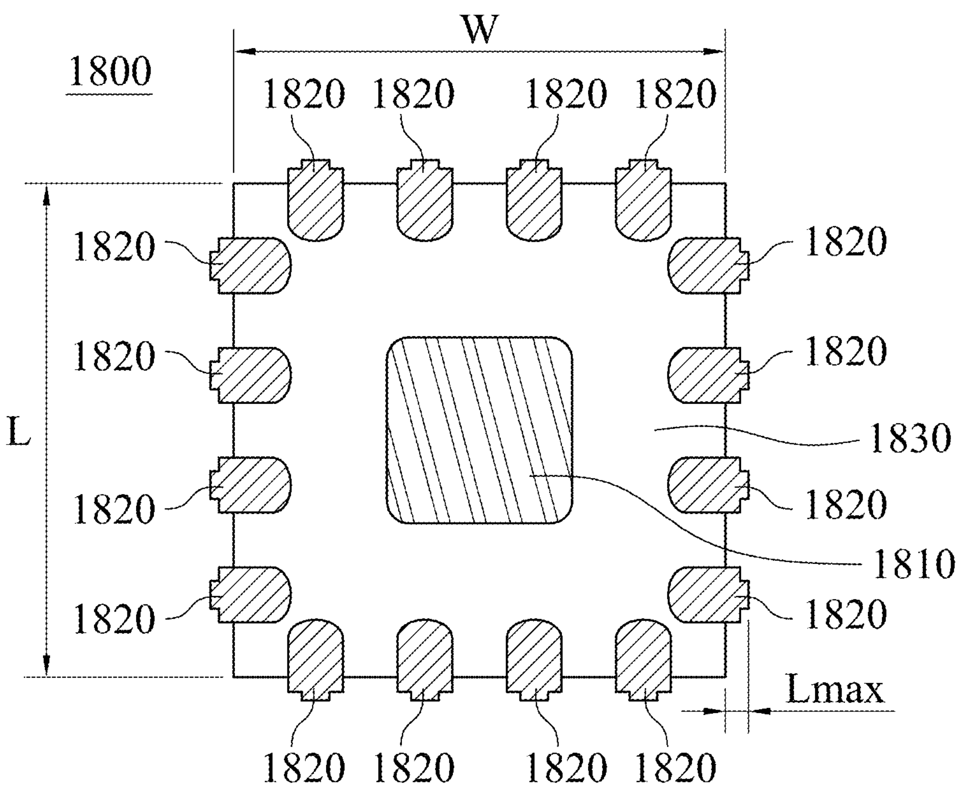

Fig. 123

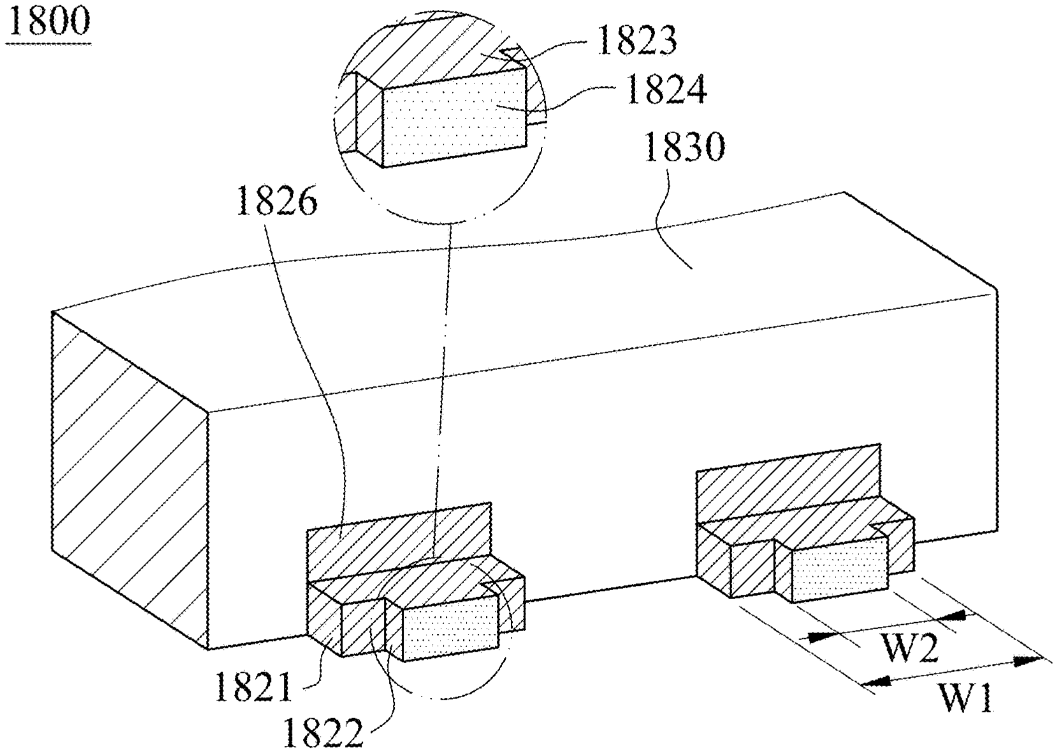

Fig. 124

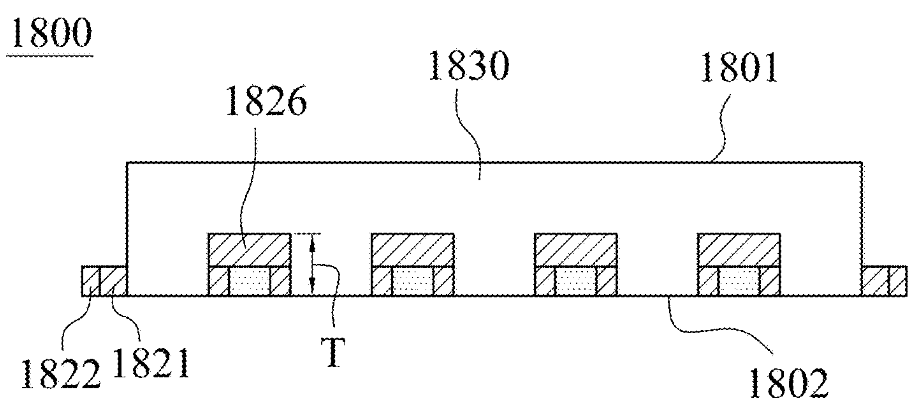

Fig. 125

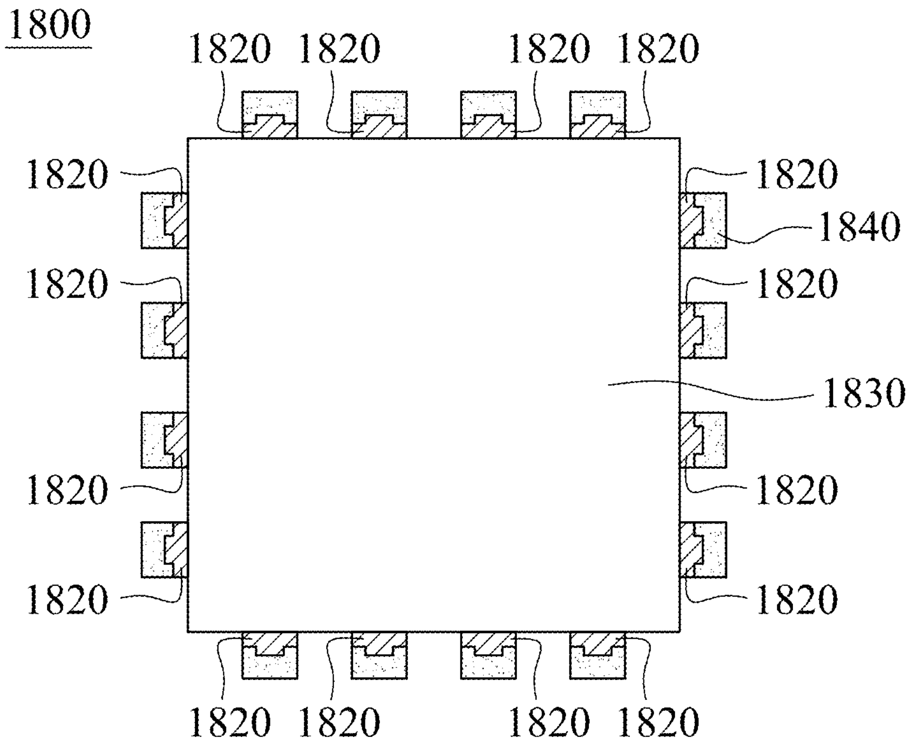

Fig. 126

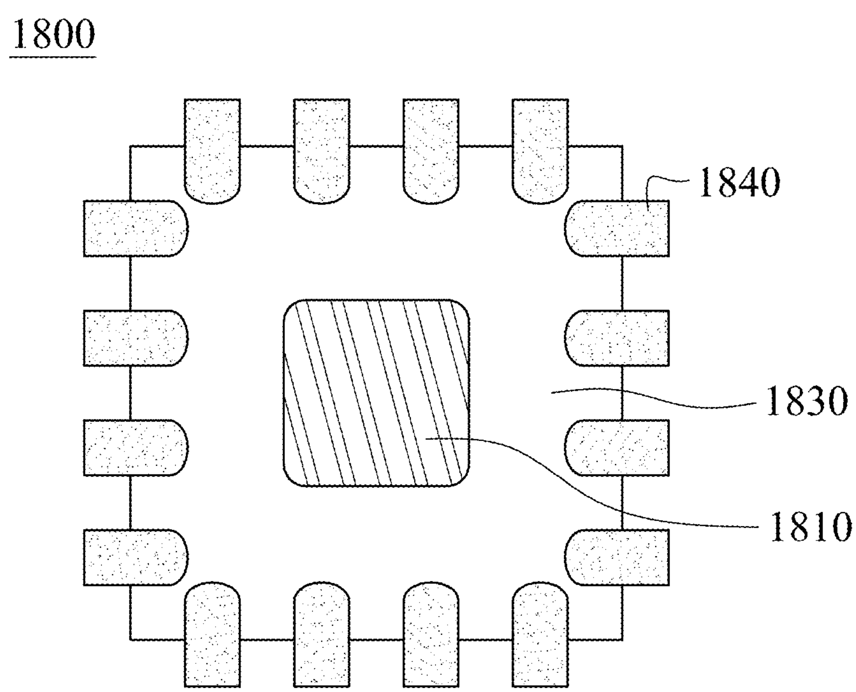

Fig. 127

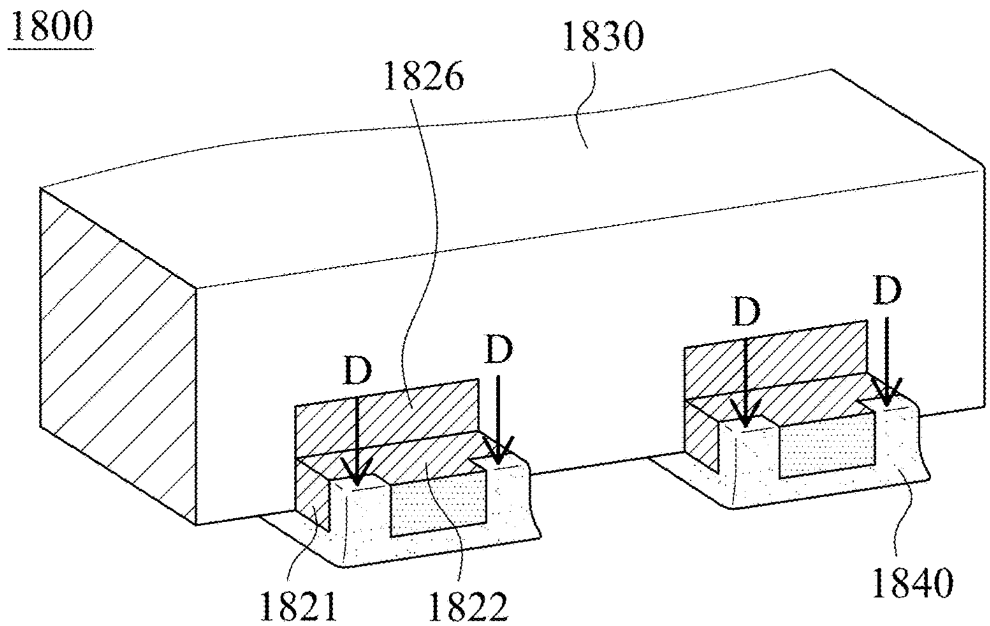

Fig. 128

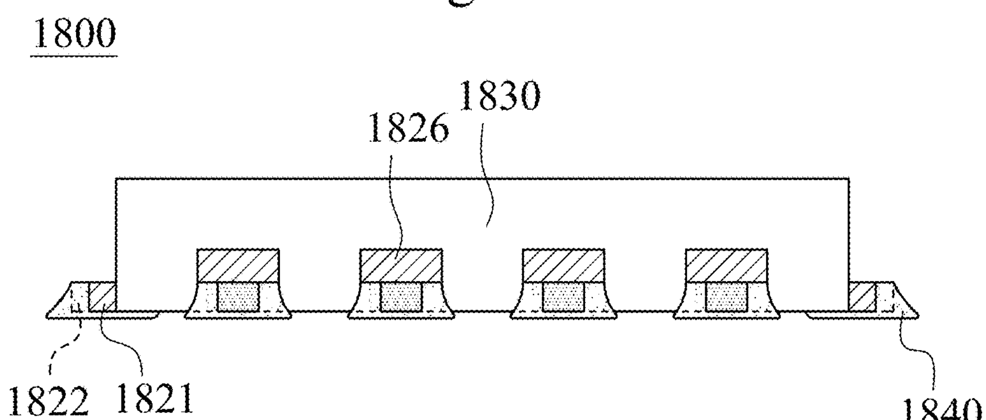

Fig. 129

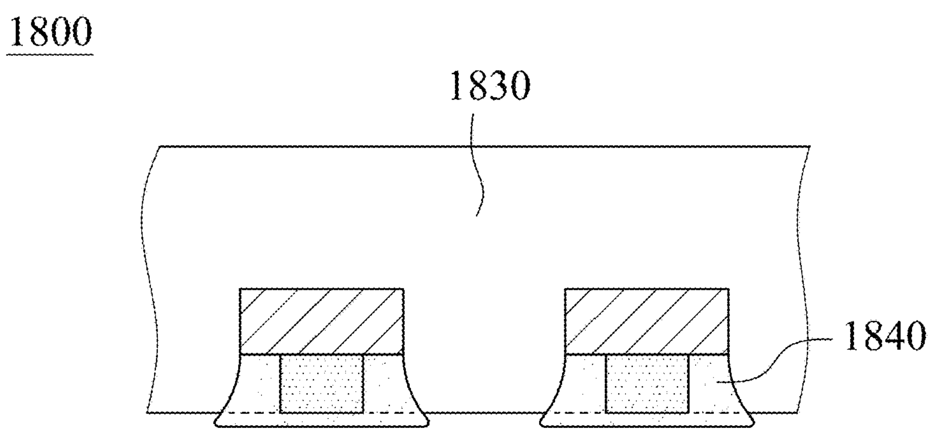

Fig. 130

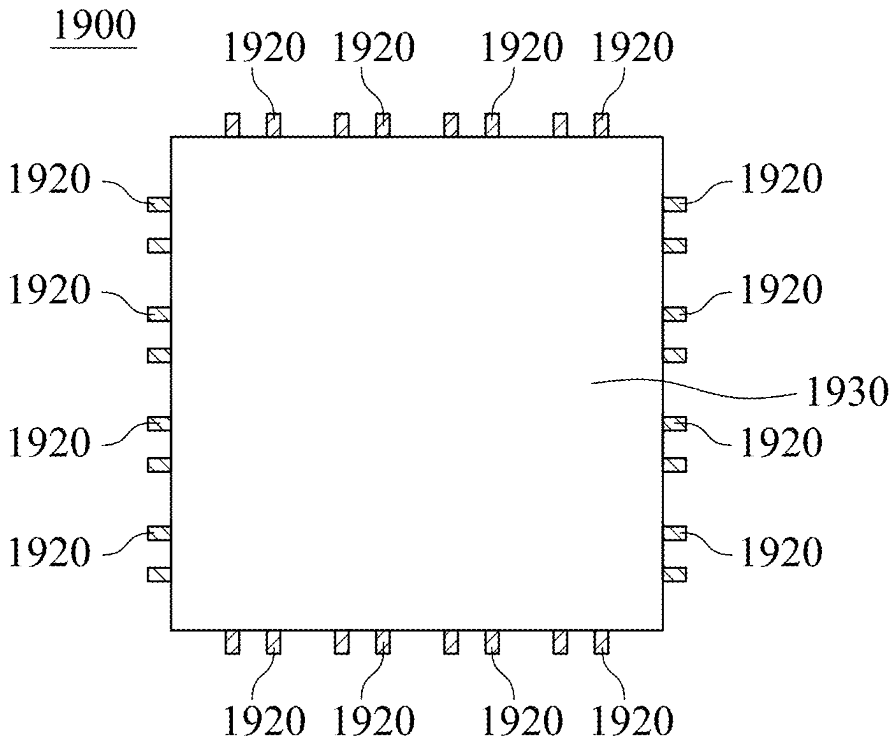

Fig. 131

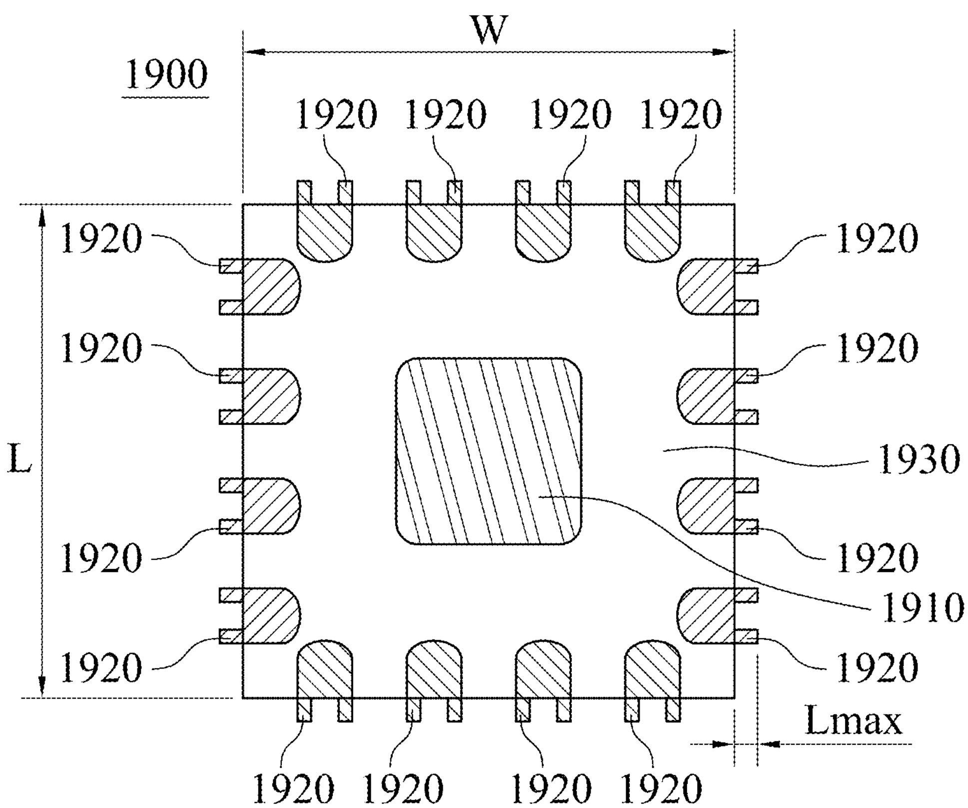

Fig. 132

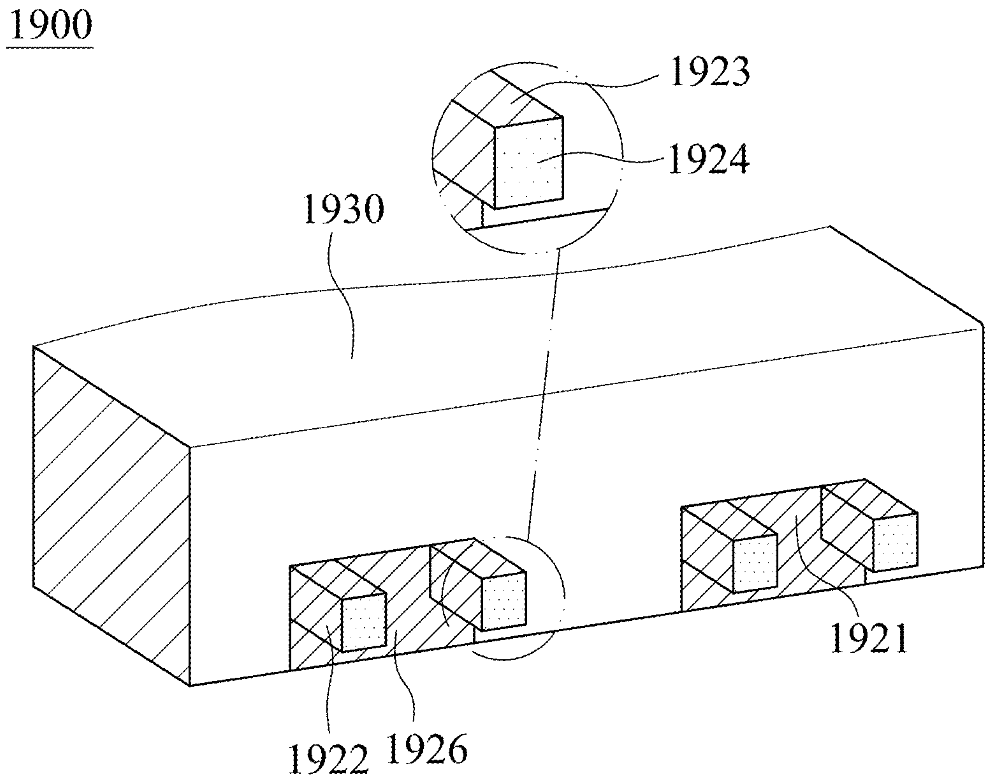

Fig. 133

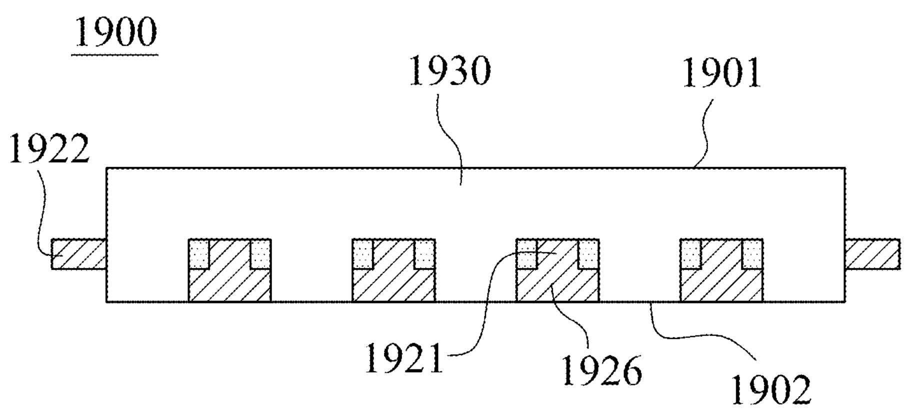

Fig. 134

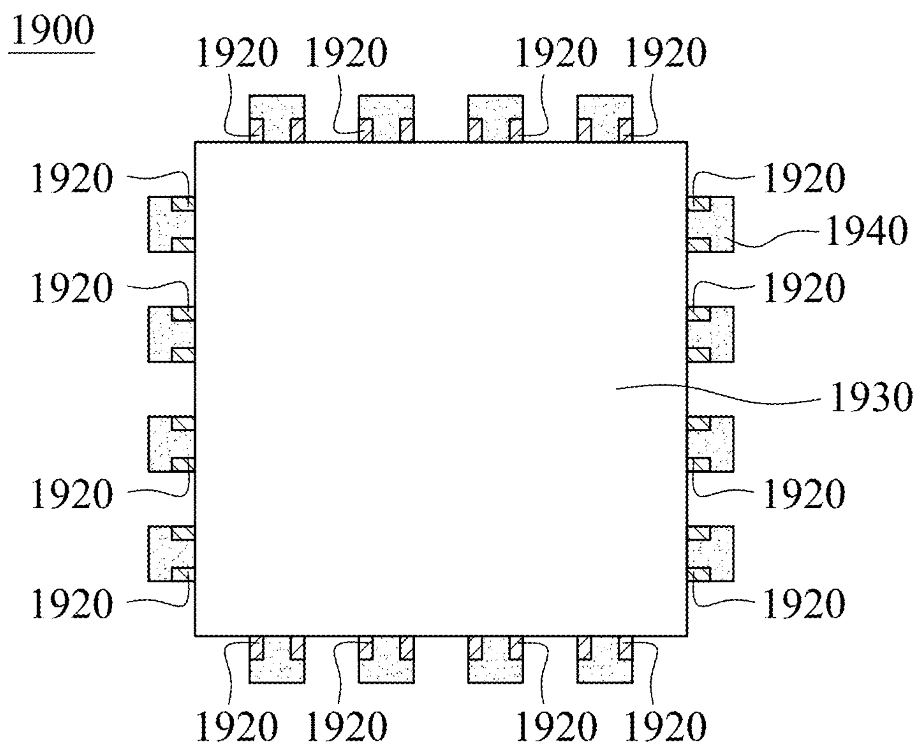

Fig. 135

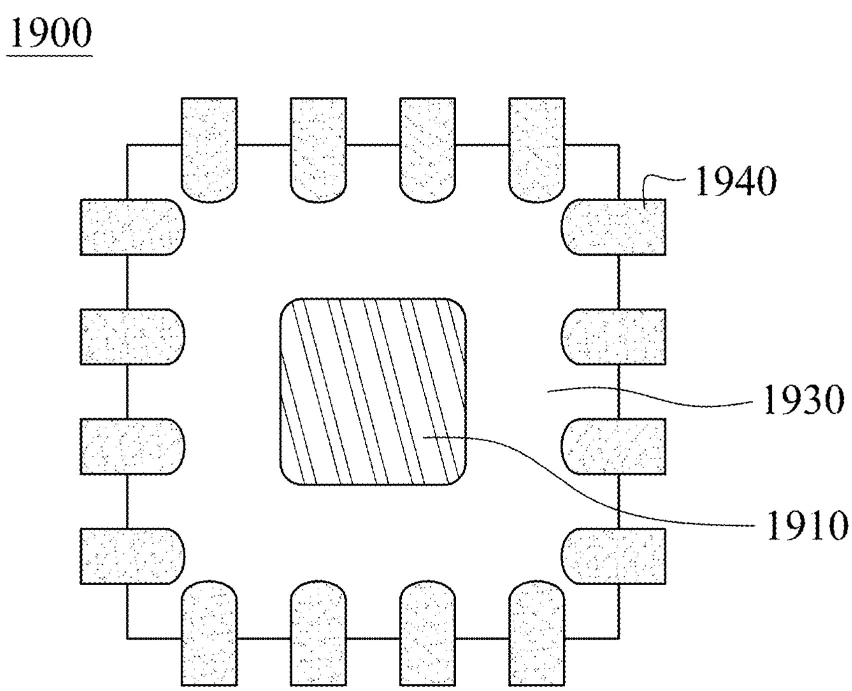

Fig. 136

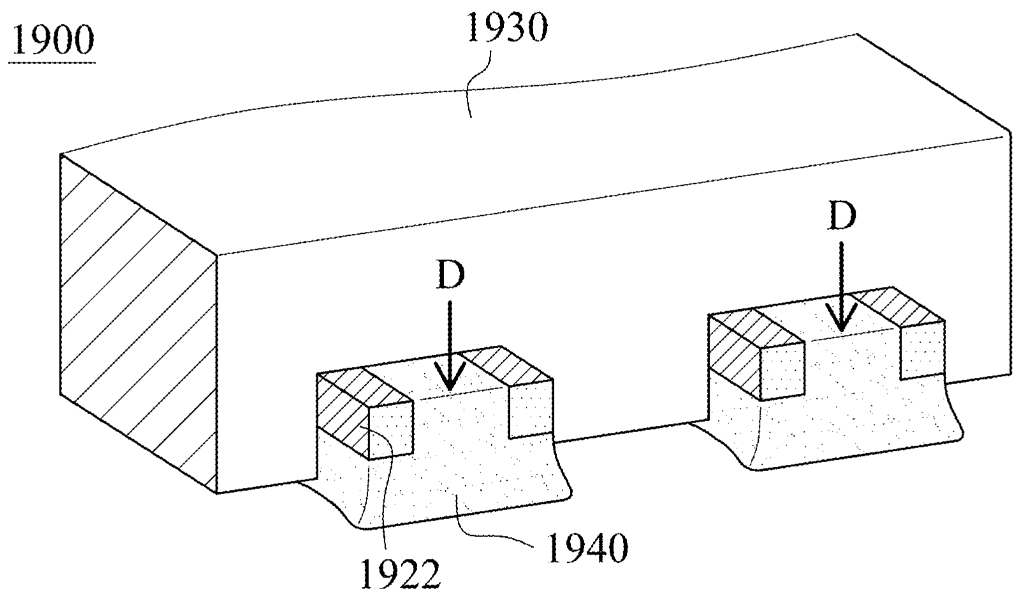

Fig. 137

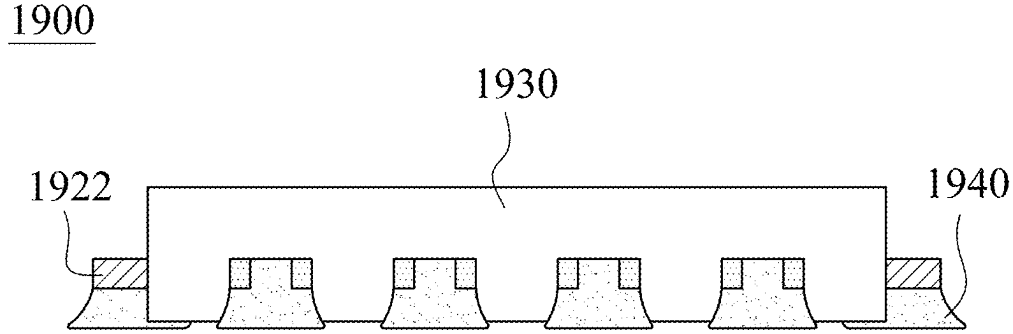

Fig. 138

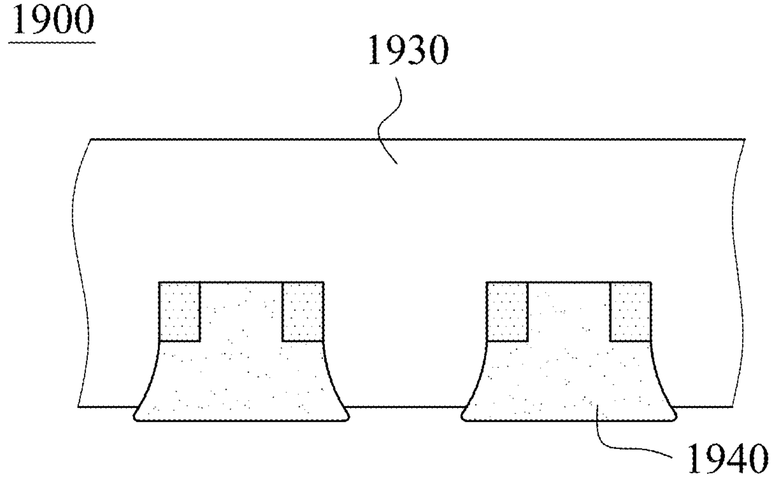

Fig. 139

PACKAGE STRUCTURE

RELATED APPLICATIONS

[0001] This application is a Divisional application of the U.S. application Ser. No. 17/723,536, filed Apr. 19, 2022, which a continuation-in-part of the application Ser. No. 17/109,255, filed on Dec. 2, 2020, which claims priority to U.S. Provisional Application Ser. No. 63/000,545, filed Mar. 27, 2020, and Taiwan Application Serial Number 109130281, filed Sep. 3, 2020, and Taiwan Application Serial Number 111100156, filed Jan. 3, 2022, which are herein incorporated by reference.

BACKGROUND

Technical Field

[0002] The present disclosure relates to a package structure. More particularly, the present disclosure relates to a package structure which solderable areas can be increased.

Description of Related Art

[0003] In recent years, a quad flat no leads (QFN) has less solderable area on sides of leads thereof. Hence, the QFN has the worse solderable effect when the QFN is disposed on a circuit board.

[0004] To solve the aforementioned problem, a structure of each of leads of a QFN being concave relative to a bottom thereof has been developed, so a solderable area of sides of the leads can be enhanced. However, an area of a bottom of the leads disposed on the circuit board is shrunken, and then the stability of the QFN disposed on the circuit board is worse to lower the lifetime of the QFN disposed on the circuit board. Therefore, a package, which the solderable area of leads can be enhanced and can be firmly disposed on the circuit board, needs to be developed.

SUMMARY

[0005] According to one aspect of the present disclosure, a package structure includes a leadframe, a semiconductor die and a plastic package material. The leadframe includes a die pad and a plurality of leads. The leads are disposed on four peripheral regions of the die pad, and each of the leads includes a main body, at least one extending portion and a plurality of plating surfaces. The extending portion is connected to the main body, and the main body and the extending portion are integrally formed. The plating surfaces are disposed on the main body and the extending portion. The semiconductor die is disposed on the die pad of the leadframe. The plastic package material is disposed on the leadframe. The main body and the extending portion of each of the leads protrude a peripheral region of the plastic package material.

[0006] According to one aspect of the present disclosure, a package structure includes a leadframe, a semiconductor die and a plastic package material. The leadframe includes a die pad and a plurality of leads. The leads are disposed on four peripheral regions of the die pad, and each of the leads includes a main body, at least one extending portion and a plurality of plating surfaces. The extending portion is connected to the main body, and the main body and the extending portion are integrally formed. The plating surfaces are disposed on the main body and the extending portion. The semiconductor die is disposed on the die pad of the leadframe. The plastic package material is disposed on the leadframe. The main body of each of the leads is aligned to a peripheral region of the plastic package material, and the extending portion of each of the leads protrudes the peripheral region of the plastic package material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a top view of a package structure according to the 1st embodiment of the present disclosure.

[0008] FIG. **2** is a bottom view of the package structure according to the 1st embodiment in FIG. **1**.

[0009] FIG. **3** is a partial schematic view of the package structure according to the 1st embodiment in FIG. **1**.

[0010] FIG. **4** is a side view of the package structure according to the 1st embodiment in FIG. **1**.

[0011] FIG. **5** is a side view of the package structure after soldering according to the 1st embodiment in FIG. **1**.

[0012] FIG. **6** is a partial side view of the package structure after soldering according to the 1st embodiment in FIG. **5**.

[0013] FIG. **7** is a top view of a package structure according to the 2nd embodiment of the present disclosure.

[0014] FIG. **8** is a bottom view of the package structure according to the 2nd embodiment in FIG. **7**.

[0015] FIG. **9** is a partial schematic view of the package structure according to the 2nd embodiment in FIG. **7**.

[0016] FIG. **10** is a side view of the package structure according to the 2nd embodiment in FIG. **7**.

[0017] FIG. **11** is a side view of the package structure after soldering according to the 2nd embodiment in FIG. **7**.

[0018] FIG. **12** is a partial side view of the package structure after soldering according to the 2nd embodiment in FIG. **11**.

[0019] FIG. **13** is a top view of a package structure according to the 3rd embodiment of the present disclosure.

[0020] FIG. **14** is a bottom view of the package structure according to the 3rd embodiment in FIG. **13**.

[0021] FIG. **15** is a partial schematic view of the package structure according to the 3rd embodiment in FIG. **13**.

[0022] FIG. **16** is a side view of the package structure according to the 3rd embodiment in FIG. **13**.

[0023] FIG. **17** is a side view of the package structure after soldering according to the 3rd embodiment in FIG. **13**.

[0024] FIG. **18** is a partial side view of the package structure after soldering according to the 3rd embodiment in FIG. **17**.

[0025] FIG. **19** is a top view of a package structure according to the 4th embodiment of the present disclosure.

[0026] FIG. **20** is a bottom view of the package structure according to the 4th embodiment in FIG. **19**.

[0027] FIG. **21** is a partial schematic view of the package structure according to the 4th embodiment in FIG. **19**.

[0028] FIG. **22** is a side view of the package structure according to the 4th embodiment in FIG. **19**.

[0029] FIG. **23** is a side view of the package structure after soldering according to the 4th embodiment in FIG. **19**.

[0030] FIG. **24** is a partial side view of the package structure after soldering according to the 4th embodiment in FIG. **23**.

[0031] FIG. **25** is a top view of a package structure according to the 5th embodiment of the present disclosure.

[0032] FIG. **26** is a bottom view of the package structure according to the 5th embodiment in FIG. **25**.

[0033] FIG. **27** is a partial schematic view of the package structure according to the 5th embodiment in FIG. **25**.

[0034] FIG. **28** is a side view of the package structure according to the 5th embodiment in FIG. **25**.

[0035] FIG. **29** is a side view of the package structure after soldering according to the 5th embodiment in FIG. **25**.

[0036] FIG. **30** is a partial side view of the package structure after soldering according to the 5th embodiment in FIG. **29**.

[0037] FIG. **31** is a top view of a package structure according to the 6th embodiment of the present disclosure.

[0038] FIG. **32** is a bottom view of the package structure according to the 6th embodiment in FIG. **31**.

[0039] FIG. **33** is a partial schematic view of the package structure according to the 6th embodiment in FIG. **31**.

[0040] FIG. **34** is a side view of the package structure according to the 6th embodiment in FIG. **31**.

[0041] FIG. **35** is a side view of the package structure after soldering according to the 6th embodiment in FIG. **31**.

[0042] FIG. **36** is a partial side view of the package structure after soldering according to the 6th embodiment in FIG. **35**.

[0043] FIG. **37** is a top view of a package structure according to the 7th embodiment of the present disclosure.

[0044] FIG. **38** is a bottom view of the package structure according to the 7th embodiment in FIG. **37**.

[0045] FIG. **39** is a partial schematic view of the package structure according to the 7th embodiment in FIG. **37**.

[0046] FIG. **40** is a side view of the package structure according to the 7th embodiment in FIG. **37**.

[0047] FIG. **41** is a cross-sectional schematic view of the package structure along a **41-41** line in FIG. **40**.

[0048] FIG. **42** is a side view of the package structure after soldering according to the 7th embodiment in FIG. **37**.

[0049] FIG. **43** is a partial side view of the package structure after soldering according to the 7th embodiment in FIG. **42**.

[0050] FIG. **44** is a top view of a package structure according to the 8th embodiment of the present disclosure.

[0051] FIG. **45** is a bottom view of the package structure according to the 8th embodiment in FIG. **44**.

[0052] FIG. **46** is a partial schematic view of the package structure according to the 8th embodiment in FIG. **44**.

[0053] FIG. **47** is a side view of the package structure according to the 8th embodiment in FIG. **44**.

[0054] FIG. **48** is a cross-sectional schematic view of the package structure along a **48-48** line in FIG. **47**.

[0055] FIG. **49** is a side view of the package structure after soldering according to the 8th embodiment in FIG. **44**.

[0056] FIG. **50** is a partial side view of the package structure after soldering according to the 8th embodiment in FIG. **49**.

[0057] FIG. **51** is a top view of a package structure according to the 9th embodiment of the present disclosure.

[0058] FIG. **52** is a bottom view of the package structure according to the 9th embodiment in FIG. **51**.

[0059] FIG. **53** is a partial schematic view of the package structure according to the 9th embodiment in FIG. **51**.

[0060] FIG. **54** is a side view of the package structure according to the 9th embodiment in FIG. **51**.

[0061] FIG. **55** is a cross-sectional schematic view of the package structure along a **55-55** line in FIG. **54**.

[0062] FIG. **56** is a side view of the package structure after soldering according to the 9th embodiment in FIG. **51**.

[0063] FIG. **57** is a partial side view of the package structure after soldering according to the 9th embodiment in FIG. **56**.

[0064] FIG. **58** is a top view of a package structure according to the 10th embodiment of the present disclosure.

[0065] FIG. **59** is a bottom view of the package structure according to the 10th embodiment in FIG. **58**.

[0066] FIG. **60** is a partial schematic view of the package structure according to the 10th embodiment in FIG. **58**.

[0067] FIG. **61** is a side view of the package structure according to the 10th embodiment in FIG. **58**.

[0068] FIG. **62** is a cross-sectional schematic view of the package structure along a **62-62** line in FIG. **61**.

[0069] FIG. **63** is a side view of the package structure after soldering according to the 10th embodiment in FIG. **58**.

[0070] FIG. **64** is a partial side view of the package structure after soldering according to the 10th embodiment in FIG. **63**.

[0071] FIG. **65** is a top view of a package structure according to the 11th embodiment of the present disclosure.

[0072] FIG. **66** is a bottom view of the package structure according to the 11th embodiment in FIG. **65**.

[0073] FIG. **67** is a partial schematic view of the package structure according to the 11th embodiment in FIG. **65**.

[0074] FIG. **68** is a side view of the package structure according to the 11th embodiment in FIG. **65**.

[0075] FIG. **69** is a cross-sectional schematic view of the package structure along a **69-69** line in FIG. **68**.

[0076] FIG. **70** is a side view of the package structure after soldering according to the 11th embodiment in FIG. **65**.

[0077] FIG. **71** is a partial side view of the package structure after soldering according to the 11th embodiment in FIG. **70**.

[0078] FIG. **72** is a top view of a package structure according to the 12th embodiment of the present disclosure.

[0079] FIG. **73** is a bottom view of the package structure according to the 12th embodiment in FIG. **72**.

[0080] FIG. **74** is a partial schematic view of the package structure according to the 12th embodiment in FIG. **72**.

[0081] FIG. **75** is a side view of the package structure according to the 12th embodiment in FIG. **72**.

[0082] FIG. **76** is a cross-sectional schematic view of the package structure along a **76-76** line in FIG. **75**.

[0083] FIG. **77** is a side view of the package structure after soldering according to the 12th embodiment in FIG. **72**.

[0084] FIG. **78** is a partial side view of the package structure after soldering according to the 12th embodiment in FIG. **77**.

[0085] FIG. **79** is a top view of a package structure according to the 13th embodiment of the present disclosure.

[0086] FIG. **80** is a bottom view of the package structure according to the 13th embodiment in FIG. **79**.

[0087] FIG. **81** is a partial schematic view of the package structure according to the 13th embodiment in FIG. **79**.

[0088] FIG. **82** is a side view of the package structure according to the 13th embodiment in FIG. **79**.

[0089] FIG. **83** is a cross-sectional schematic view of the package structure along an **83-83** line in FIG. **82**.

[0090] FIG. **84** is a side view of the package structure after soldering according to the 13th embodiment in FIG. **79**.

[0091] FIG. **85** is a partial side view of the package structure after soldering according to the 13th embodiment in FIG. **84**.

[0092] FIG. **86** is a top view of a package structure according to the 14th embodiment of the present disclosure.

[0093] FIG. **87** is a bottom view of the package structure according to the 14th embodiment in FIG. **86**.

[0094] FIG. **88** is a partial schematic view of the package structure according to the 14th embodiment in FIG. **86**.

[0095] FIG. **89** is a side view of the package structure according to the 14th embodiment in FIG. **86**.

[0096] FIG. **90** is a top view of the package structure after soldering according to the 14th embodiment in FIG. **86**.

[0097] FIG. **91** is a bottom view of the package structure after soldering according to the 14th embodiment in FIG. **86**.

[0098] FIG. **92** is a partial side view of the package structure after soldering according to the 14th embodiment in FIG. **86**.

[0099] FIG. **93** is a side view of the package structure after soldering according to the 14th embodiment in FIG. **86**.

[0100] FIG. **94** is a partial side view of the package structure after soldering according to the 14th embodiment in FIG. **93**.

[0101] FIG. **95** is a top view of a package structure according to the 15th embodiment of the present disclosure.

[0102] FIG. **96** is a bottom view of the package structure according to the 15th embodiment in FIG. **95**.

[0103] FIG. **97** is a partial schematic view of the package structure according to the 15th embodiment in FIG. **95**.

[0104] FIG. **98** is a side view of the package structure according to the 15th embodiment in FIG. **95**.

[0105] FIG. **99** is a top view of the package structure after soldering according to the 15th embodiment in FIG. **95**.

[0106] FIG. **100** is a bottom view of the package structure after soldering according to the 15th embodiment in FIG. **95**.

[0107] FIG. **101** is a partial side view of the package structure after soldering according to the 15th embodiment in FIG. **95**.

[0108] FIG. **102** is a side view of the package structure after soldering according to the 15th embodiment in FIG. **95**.

[0109] FIG. **103** is a partial side view of the package structure after soldering according to the 15th embodiment in FIG. **102**.

[0110] FIG. **104** is a top view of a package structure according to the 16th embodiment of the present disclosure.

[0111] FIG. **105** is a bottom view of the package structure according to the 16th embodiment in FIG. **104**.

[0112] FIG. **106** is a partial schematic view of the package structure according to the 16th embodiment in FIG. **104**.

[0113] FIG. **107** is a side view of the package structure according to the 16th embodiment in FIG. **104**.

[0114] FIG. **108** is a top view of the package structure after soldering according to the 16th embodiment in FIG. **104**.

[0115] FIG. **109** is a bottom view of the package structure after soldering according to the 16th embodiment in FIG. **104**.

[0116] FIG. **110** is a partial side view of the package structure after soldering according to the 16th embodiment in FIG. **104**.

[0117] FIG. **111** is a side view of the package structure after soldering according to the 16th embodiment in FIG. **104**.

[0118] FIG. **112** is a partial side view of the package structure after soldering according to the 16th embodiment in FIG. **111**.

[0119] FIG. **113** is a top view of a package structure according to the 17th embodiment of the present disclosure.

[0120] FIG. **114** is a bottom view of the package structure according to the 17th embodiment in FIG. **113**.

[0121] FIG. **115** is a partial schematic view of the package structure according to the 17th embodiment in FIG. **113**.

[0122] FIG. **116** is a side view of the package structure according to the 17th embodiment in FIG. **113**.

[0123] FIG. **117** is a top view of the package structure after soldering according to the 17th embodiment in FIG. **113**.

[0124] FIG. **118** is a bottom view of the package structure after soldering according to the 17th embodiment in FIG. **113**.

[0125] FIG. **119** is a partial side view of the package structure after soldering according to the 17th embodiment in FIG. **113**.

[0126] FIG. **120** is a side view of the package structure after soldering according to the 17th embodiment in FIG. **113**.

[0127] FIG. **121** is a partial side view of the package structure after soldering according to the 17th embodiment in FIG. **120**.

[0128] FIG. **122** is a top view of a package structure according to the 18th embodiment of the present disclosure.

[0129] FIG. **123** is a bottom view of the package structure according to the 18th embodiment in FIG. **122**.

[0130] FIG. **124** is a partial schematic view of the package structure according to the 18th embodiment in FIG. **122**.

[0131] FIG. **125** is a side view of the package structure according to the 18th embodiment in FIG. **122**.

[0132] FIG. **126** is a top view of the package structure after soldering according to the 18th embodiment in FIG. **122**.

[0133] FIG. **127** is a bottom view of the package structure after soldering according to the 18th embodiment in FIG. **122**.

[0134] FIG. **128** is a partial side view of the package structure after soldering according to the 18th embodiment in FIG. **122**.

[0135] FIG. **129** is a side view of the package structure after soldering according to the 18th embodiment in FIG. **122**.

[0136] FIG. **130** is a partial side view of the package structure after soldering according to the 18th embodiment in FIG. **129**.

[0137] FIG. **131** is a top view of a package structure according to the 19th embodiment of the present disclosure.

[0138] FIG. **132** is a bottom view of the package structure according to the 19th embodiment in FIG. **131**.

[0139] FIG. **133** is a partial schematic view of the package structure according to the 19th embodiment in FIG. **131**.

[0140] FIG. **134** is a side view of the package structure according to the 19th embodiment in FIG. **131**.

[0141] FIG. **135** is a top view of the package structure after soldering according to the 19th embodiment in FIG. **131**.

[0142] FIG. **136** is a bottom view of the package structure after soldering according to the 19th embodiment in FIG. **131**.

[0143] FIG. **137** is a partial side view of the package structure after soldering according to the 19th embodiment in FIG. **131**.

[0144] FIG. **138** is a side view of the package structure after soldering according to the 19th embodiment in FIG. **131**.

[0145] FIG. **139** is a partial side view of the package structure after soldering according to the 19th embodiment in FIG. **138**.

DETAILED DESCRIPTION

[0146] FIG. **1** is a top view of a package structure **100** according to the 1st embodiment of the present disclosure. FIG. **2** is a bottom view of the package structure **100** according to the 1st embodiment in FIG. **1**. FIG. **3** is a partial schematic view of the package structure **100** according to the 1st embodiment in FIG. **1**. In FIGS. **1** to **3**, the package structure **100** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **130**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **130** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **130** to form the package structure **100**.

[0147] Moreover, the leadframe includes a die pad **110** and a plurality of leads, wherein each of the leads can be a step-shaped lead **120**, the step-shaped leads **120** are disposed on four sides of the die pad **110**, and each of the step-shaped leads **120** includes a plurality of plating surfaces **121** and at least one non-plating surface **122**. The semiconductor die is disposed on the die pad **110** of the leadframe, the plastic package material **130** is disposed on the leadframe, and each of the step-shaped leads **120** protrudes an outer region of the plastic package material **130**. Therefore, the step-shaped leads **120** which protrude sides of the package structure **100** are favorable for enhancing the solderable area of the sides of the package structure **100**.

[0148] According to the 1st embodiment, the package structure **100** can be obtained by an etching step, a molding step, two laser steps, a plating step and a singulation step. In the etching step, a lower surface of the leadframe is etched. In the molding step, the plastic package material **130** is disposed on and covers the semiconductor die. In the laser steps, each of a portion of the plastic package material **130** on an upper surface of the leadframe and a portion of the plastic package material **130** on the lower surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **121** are disposed on a surface of the leadframe without the plastic package material **130** after the laser steps. In the singulation step, the package structure **100** is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0149] In FIG. **2**, when a length of the plastic package material **130** is L, a width of the plastic package material **130** is W, and a maximum protruding length of each of the leads (according to the 1st embodiment, each of the leads is the step-shaped lead **120**) is L2, the following conditions can be satisfied: $W \leq L$, $0.01\ W \leq L2$, and $L2 \leq 0.5L$. In particular, the plastic package material **130** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the step-shaped leads **120** can be the same. Therefore, the solderable area of the step-shaped leads **120** at the sides of the package structure **100** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **100** soldered on the circuit board (not shown), and the package structure **100** can be firmly disposed on the circuit board.

[0150] In detail, the plating surfaces **121** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **130** can be made of an epoxy resin, but are not limited thereto.

[0151] FIG. **4** is a side view of the package structure **100** according to the 1st embodiment in FIG. **1**. In FIGS. **3** and **4**, a protruding length of a portion of each of the step-shaped leads **120** close to a lower surface **102** of the package structure **100** is smaller than a protruding length of another portion of each of the step-shaped leads **120** close to an upper surface **101** of the package structure **100**. Moreover, the portion of each of the step-shaped leads **120** close to the lower surface **102** of the package structure **100** does not protrude an edge of the plastic package material **130**. Therefore, according to the 1st embodiment, the package outline drawing (POD) does not need to be changed, and the process of redrawing the POD can be reduced. Furthermore, a thickness of each of the step-shaped leads **120** is thinner, so the burr can be reduced.

[0152] Moreover, a minimum protruding length of each of the step-shaped leads **120** is aligned to the edge of the plastic package material **130** (that is, the portion of each of the step-shaped leads **120** close to the lower surface **102** of the package structure **100**), and a length of a bottom of each of the step-shaped leads **120** contact with the circuit board is not reduced. Therefore, according to the 1st embodiment, not only can the solderable area of the side of the each of the step-shaped leads **120** be increased, the connection strength between the bottom of the step-shaped leads **120** and the circuit board can also be simultaneously maintained to increase the lifetime of the package structure **100** disposed on the circuit board.

[0153] FIG. **5** is a side view of the package structure **100** after soldering according to the 1st embodiment in FIG. **1**. FIG. **6** is a partial side view of the package structure **100** after soldering according to the 1st embodiment in FIG. **5**. A number of the plating surfaces **121** can be at least four. In FIGS. **3** to **6**, according to the 1st embodiment, the number of the plating surfaces **121** is five, but is not limited thereto. Further, in FIGS. **5** and **6**, soldering portions **140** of the package structure **100** can be only disposed on the plating surfaces **121**. Therefore, the soldering strength between the package structure **100** and the circuit board is increased when the package structure **100** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the step-shaped leads **120**.

[0154] FIG. **7** is a top view of a package structure **200** according to the 2nd embodiment of the present disclosure. FIG. **8** is a bottom view of the package structure **200** according to the 2nd embodiment in FIG. **7**. FIG. **9** is a partial schematic view of the package structure **200** according to the 2nd embodiment in FIG. **7**. In FIGS. **7** to **9**, the package structure **200** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **230**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **230** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **230** to form the package structure **200**.

[0155] Moreover, the leadframe includes a die pad **210** and a plurality of leads, wherein each of the leads can be a step-shaped lead **220**, the step-shaped leads **220** are disposed on four sides of the die pad **210**, and each of the step-shaped leads **220** includes a plurality of plating surfaces **221** and at least one non-plating surface **222**. The semiconductor die is disposed on the die pad **210** of the leadframe, the plastic package material **230** is disposed on the leadframe, and each of the step-shaped leads **220** protrudes an outer region of the plastic package material **230**. Therefore, the step-shaped leads **220** which protrude sides of the package structure **200** are favorable for enhancing the solderable area of the sides of the package structure **200**.

[0156] According to the 2nd embodiment, the package structure **200** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step. In the etching step, a lower surface of the leadframe is etched. In the molding step, the plastic package material **230** is disposed on and covers the semiconductor die. In the laser step, each of a portion of the plastic package material **230** and a portion of the leadframe on an upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **221** are disposed on a surface of the leadframe without the plastic package material **230** after the laser step. In the singulation step, the package structure **200** is formed. Moreover, a number of the laser step can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0157] In FIG. **8**, when a length of the plastic package material **230** is L, a width of the plastic package material **230** is W, and a maximum protruding length of each of the leads (according to the 2nd embodiment, each of the leads is the step-shaped lead **220**) is L2, the following conditions can be satisfied: $W \leq L$, $0.01\ W \leq L2$, and $L2 \leq 0.5L$. In particular, the plastic package material **230** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the step-shaped leads **220** can be the same. Therefore, the solderable area of the step-shaped leads **220** at the sides of the package structure **200** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **200** soldered on the circuit board (not shown), and the package structure **200** can be firmly disposed on the circuit board.

[0158] In detail, the plating surfaces **221** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **230** can be made of an epoxy resin, but are not limited thereto.

[0159] FIG. **10** is a side view of the package structure **200** according to the 2nd embodiment in FIG. **7**. In FIGS. **9** and **10**, a protruding length of a portion of each of the step-shaped leads **220** close to an upper surface **201** of the package structure **200** is smaller than a protruding length of another portion of each of the step-shaped leads **220** close to a lower surface **202** of the package structure **200**. Moreover, the portion of each of the step-shaped leads **220** close to the upper surface **201** of the package structure **200** does not protrude an edge of the plastic package material **230**. Furthermore, a protruding width of each of the step-shaped leads **220** is wider, and a thickness of each of the step-shaped leads **220** is thinner, so the burr can be reduced.

[0160] Moreover, the protruding length of another portion of each of the step-shaped leads **220** close to the lower surface **202** of the package structure **200** protrudes an edge of the plastic package material **230**. Therefore, according to the 2nd embodiment, not only can the solderable area of the side of the each of the step-shaped leads **220** be increased, the connection strength between the bottom of the step-shaped leads **220** and the circuit board can also be simultaneously maintained to increase the lifetime of the package structure **200** disposed on the circuit board.

[0161] FIG. **11** is a side view of the package structure **200** after soldering according to the 2nd embodiment in FIG. **7**. FIG. **12** is a partial side view of the package structure **200** after soldering according to the 2nd embodiment in FIG. **11**. A number of the plating surfaces **221** can be at least four. In FIGS. **9** to **12**, according to the 2nd embodiment, the number of the plating surfaces **221** is five, but is not limited thereto. Further, in FIGS. **11** and **12**, soldering portions **240** of the package structure **200** can be only disposed on the plating surfaces **221**. Therefore, the soldering strength between the package structure **200** and the circuit board is increased when the package structure **200** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the step-shaped leads **220**.

[0162] FIG. **13** is a top view of a package structure **300** according to the 3rd embodiment of the present disclosure. FIG. **14** is a bottom view of the package structure **300** according to the 3rd embodiment in FIG. **13**. FIG. **15** is a partial schematic view of the package structure **300** according to the 3rd embodiment in FIG. **13**. In FIGS. **13** to **15**, the package structure **300** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **330**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **330** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **330** to form the package structure **300**.

[0163] Moreover, the leadframe includes a die pad **310** and a plurality of leads, wherein each of the leads can be a step-shaped lead **320**, the step-shaped leads **320** are disposed on four sides of the die pad **310**, and each of the step-shaped leads **320** includes a plurality of plating surfaces **321**, at least one non-plating surface **322** and a concave portion **323**, wherein the concave portion **323** is located on a surface of each of the step-shaped leads **320**, and the plating surfaces **321** are disposed on each of the step-shaped leads **320** and the concave portion **323**. The semiconductor die is disposed on the die pad **310** of the leadframe, the plastic package material **330** is disposed on the leadframe, and each of the step-shaped leads **320** protrudes an outer region of the plastic package material **330**. Therefore, the step-shaped leads **320** which protrude sides of the package structure **300** are favorable for enhancing the solderable area of the sides of the package structure **300**.

[0164] According to the 3rd embodiment, the package structure **300** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step. In the etching step, a lower surface of the leadframe is etched. In the molding step, the plastic package material **330** is disposed on and covers the semiconductor die. In the laser step, each of a portion of the plastic package material **330** and a portion of the leadframe on an upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **321** are disposed on a surface of the leadframe without the plastic package material **330** after the laser step. In the singulation step, the package structure **300** is formed. Moreover, a number of the laser step can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0165] In FIG. **14**, when a length of the plastic package material **330** is L, a width of the plastic package material **330** is W, and a maximum protruding length of each of the leads (according to the 3rd embodiment, each of the leads is the step-shaped lead **320**) is L2, the following conditions can be satisfied: W≤L, 0.01 W≤L2, and L2≤0.5L. In particular, the plastic package material **330** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the step-shaped leads **320** can be the same. Therefore, the solderable area of the step-shaped leads **320** at the sides of the package structure **300** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **300** soldered on the circuit board (not shown), and the package structure **300** can be firmly disposed on the circuit board.

[0166] In detail, the plating surfaces **321** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **330** can be made of an epoxy resin, but are not limited thereto.

[0167] FIG. **16** is a side view of the package structure **300** according to the 3rd embodiment in FIG. **13**. In FIGS. **15** and **16**, a protruding length of a portion of each of the step-shaped leads **320** close to an upper surface **301** of the package structure **300** is smaller than a protruding length of another portion of each of the step-shaped leads **320** close to a lower surface **302** of the package structure **300**. Moreover, a concave depth of the concave portion **323** of each of the step-shaped leads **320** can be equal to half of a thickness of another portion of each of the step-shaped leads **320** close to the lower surface **302** of the package structure **300**. Further, a thickness of each of the step-shaped leads **320** is thinner, so the burr can be reduced.

[0168] Moreover, the protruding length of another portion of each of the step-shaped leads **320** close to the lower surface **302** of the package structure **300** protrudes an edge of the plastic package material **330**. Therefore, according to the 3rd embodiment, not only can the solderable area of the side of the each of the step-shaped leads **320** be increased, the connection strength between the bottom of the step-shaped leads **320** and the circuit board can also be simultaneously maintained to increase the lifetime of the package structure **300** disposed on the circuit board.

[0169] FIG. **17** is a side view of the package structure **300** after soldering according to the 3rd embodiment in FIG. **13**. FIG. **18** is a partial side view of the package structure **300** after soldering according to the 3rd embodiment in FIG. **17**. A number of the plating surfaces **321** can be at least four. In FIGS. **15** to **18**, according to the 3rd embodiment, the number of the plating surfaces **321** is eight, but is not limited thereto. Further, in FIGS. **17** and **18**, soldering portions **340** of the package structure **300** can be only disposed on the plating surfaces **321**. Therefore, the soldering strength between the package structure **300** and the circuit board is increased when the package structure **300** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the step-shaped leads **320**.

[0170] FIG. **19** is a top view of a package structure **400** according to the 4th embodiment of the present disclosure. FIG. **20** is a bottom view of the package structure **400** according to the 4th embodiment in FIG. **19**. FIG. **21** is a partial schematic view of the package structure **400** according to the 4th embodiment in FIG. **19**. In FIGS. **19** to **21**, the package structure **400** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **430**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **430** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **430** to form the package structure **400**.

[0171] Moreover, the leadframe includes a die pad **410** and a plurality of leads, wherein each of the leads can be a step-shaped lead **420**, the step-shaped leads **420** are disposed on four sides of the die pad **410**, and each of the step-shaped leads **420** includes a plurality of plating surfaces **421** and at least one non-plating surface **422**. The semiconductor die is disposed on the die pad **410** of the leadframe, the plastic package material **430** is disposed on the leadframe, and each of the step-shaped leads **420** protrudes an outer region of the plastic package material **430**. Therefore, the step-shaped leads **420** which protrude sides of the package structure **400** are favorable for enhancing the solderable area of the sides of the package structure **400**.

[0172] According to the 4th embodiment, the package structure **400** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step. In the etching step, an upper surface of the leadframe is etched. In the molding step, the plastic package material **430** is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material **430** on an upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **421** are disposed on a surface of the leadframe without the plastic package material **430** after the laser step. In the singulation step, the package structure **400** is formed. Moreover, a number of the laser step can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0173] In FIG. **20**, when a length of the plastic package material **430** is L, a width of the plastic package material **430** is W, and a maximum protruding length of each of the leads (according to the 4th embodiment, each of the leads is the step-shaped lead **420**) is L2, the following conditions can be satisfied: W≤L, 0.01 W≤L2, and L2≤0.5L. In particular, the plastic package material **430** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the step-shaped leads **420** can be the same. Therefore, the solderable area of the step-shaped leads **420** at the sides of the package structure **400** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **400** soldered on the circuit board (not shown), and the package structure **400** can be firmly disposed on the circuit board.

[0174] In detail, the plating surfaces **421** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **430** can be made of an epoxy resin, but are not limited thereto.

[0175] FIG. **22** is a side view of the package structure **400** according to the 4th embodiment in FIG. **19**. In FIGS. **21** and **22**, a protruding length of a portion of each of the step-shaped leads **420** close to an upper surface **401** of the package structure **400** is smaller than a protruding length of another portion of each of the step-shaped leads **420** close to a lower surface **402** of the package structure **400**. Further, a protruding width of each of the step-shaped leads **420** is wider, and a thickness of each of the step-shaped leads **420** is thinner, so the burr can be reduced.

[0176] Moreover, the protruding length of another portion of each of the step-shaped leads **420** close to the lower surface **402** of the package structure **400** protrudes an edge of the plastic package material **430**. Therefore, according to the 4th embodiment, not only can the solderable area of the side of the each of the step-shaped leads **420** be increased, the connection strength between the bottom of the step-shaped leads **420** and the circuit board can only be simultaneously maintained to increase the lifetime of the package structure **400** disposed on the circuit board.

[0177] FIG. **23** is a side view of the package structure **400** after soldering according to the 4th embodiment in FIG. **19**. FIG. **24** is a partial side view of the package structure **400** after soldering according to the 4th embodiment in FIG. **23**. A number of the plating surfaces **421** can be at least four. In FIGS. **21** to **24**, according to the 4th embodiment, the number of the plating surfaces **421** is six, but is not limited thereto. Further, in FIGS. **23** and **24**, soldering portions **440** of the package structure **400** can be only disposed on the plating surfaces **421**. Therefore, the soldering strength between the package structure **400** and the circuit board is increased when the package structure **400** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the step-shaped leads **420**.

[0178] FIG. **25** is a top view of a package structure **500** according to the 5th embodiment of the present disclosure. FIG. **26** is a bottom view of the package structure **500** according to the 5th embodiment in FIG. **25**. FIG. **27** is a partial schematic view of the package structure **500** according to the 5th embodiment in FIG. **25**. In FIGS. **25** to **27**, the package structure **500** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **530**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **530** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **530** to form the package structure **500**.

[0179] Moreover, the leadframe includes a die pad **510** and a plurality of leads, wherein each of the leads can be a step-shaped lead **520**, the step-shaped leads **520** are disposed on four sides of the die pad **510**, and each of the step-shaped leads **520** includes a plurality of plating surfaces **521** and at least one non-plating surface **522**. The semiconductor die is disposed on the die pad **510** of the leadframe, the plastic package material **530** is disposed on the leadframe, and each of the step-shaped leads **520** protrudes an outer region of the plastic package material **530**. Therefore, the step-shaped leads **520** which protrude sides of the package structure **500** are favorable for enhancing the solderable area of sides of the package structure **500**.

[0180] According to the 5th embodiment, the package structure **500** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step. In the etching step, an upper surface of the leadframe is etched. In the molding step, the plastic package material **530** is disposed on and covers the semiconductor die. In the laser step, each of a portion of the plastic package material **530** and a portion of the leadframe on an upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **521** are disposed on a surface of the leadframe without the plastic package material **530** after the laser step. In the singulation step, the package structure **500** is formed. Moreover, a number of the laser step can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0181] In FIG. **26**, when a length of the plastic package material **530** is L, a width of the plastic package material **530** is W, and a maximum protruding length of each of the leads (according to the 5th embodiment, each of the leads is the step-shaped lead **520**) is L2, the following conditions can be satisfied: $W \leq L$, $0.01\,W \leq L2$, and $L2 \leq 0.5L$. In particular, the plastic package material **530** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the step-shaped leads **520** can be the same. Therefore, the solderable area of the step-shaped leads **520** at the sides of the package structure **500** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **500** soldered on the circuit board (not shown), and the package structure **500** can be firmly disposed on the circuit board.

[0182] In detail, the plating surfaces **521** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **530** can be made of an epoxy resin, but are not limited thereto.

[0183] FIG. **28** is a side view of the package structure **500** according to the 5th embodiment in FIG. **25**. In FIGS. **27** and **28**, a protruding length of a portion of each of the step-shaped leads **520** close to an upper surface **501** of the package structure **500** is smaller than a protruding length of another portion of each of the step-shaped leads **520** close to a lower surface **502** of the package structure **500**. Moreover, the portion of each of the step-shaped leads **520** close to the upper surface **501** of the package structure **500** does not protrude an edge of the plastic package material **530**, and the protruding length of another portion of each of the step-shaped leads **520** close to the lower surface **502** of the package structure **500** is tapered to the protruding length of the portion of each of the step-shaped leads **520** close to the upper surface **501** of the package structure **500**.

[0184] Furthermore, a protruding width of each of the step-shaped leads **520** is wider, and a thickness of each of the step-shaped leads **520** is thinner, so the burr can be reduced.

[0185] Moreover, the protruding length of another portion of each of the step-shaped leads **520** close to the lower surface **502** of the package structure **500** protrudes an edge of the plastic package material **530**. Therefore, according to the 5th embodiment, not only can the solderable area of the side of the each of the step-shaped leads **520** be increased, the connection strength between the bottom of the step-shaped leads **520** and the circuit board can also be simultaneously maintained to increase the lifetime of the package structure **500** disposed on the circuit board.

[0186] FIG. **29** is a side view of the package structure **500** after soldering according to the 5th embodiment in FIG. **25**. FIG. **30** is a partial side view of the package structure **500** after soldering according to the 5th embodiment in FIG. **29**. A number of the plating surfaces **521** can be at least four. In FIGS. **27** to **30**, according to the 5th embodiment, the number of the plating surfaces **521** is seven, but is not limited thereto. Further, in FIGS. **29** and **30**, soldering portions **540** of the package structure **500** can be only disposed on the plating surfaces **521**. Therefore, the soldering strength between the package structure **500** and the circuit board is increased when the package structure **500** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the step-shaped leads **520**.

[0187] FIG. **31** is a top view of a package structure **600** according to the 6th embodiment of the present disclosure. FIG. **32** is a bottom view of the package structure **600** according to the 6th embodiment in FIG. **31**. FIG. **33** is a partial schematic view of the package structure **600** according to the 6th embodiment in FIG. **31**. In FIGS. **31** to **33**, the package structure **600** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **630**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **630** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **630** to form the package structure **600**.

[0188] Moreover, the leadframe includes a die pad **610** and a plurality of leads, wherein each of the leads can be a step-shaped lead **620**, the step-shaped leads **620** are disposed on four sides of the die pad **610**, and each of the step-shaped leads **620** includes a plurality of plating surfaces **621**, at least one non-plating surface **622** and a concave portion **623**, wherein the concave portion **623** is located on a surface of each of the step-shaped leads **620**, and the plating surfaces **621** are disposed on each of the step-shaped leads **620** and the concave portion **623**. The semiconductor die is disposed on the die pad **610** of the leadframe, the plastic package material **630** is disposed on the leadframe, and each of the step-shaped leads **620** protrudes an outer region of the plastic package material **630**. Therefore, the step-shaped leads **620** which protrude sides of the package structure **600** are favorable for enhancing the solderable area of sides of the package structure **600**.

[0189] According to the 6th embodiment, the package structure **600** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step. In the etching step, an upper surface of the leadframe is etched. In the molding step, the plastic package material **630** is disposed on and covers the semiconductor die. In the laser step, each of a portion of the plastic package material **630** and a portion of the leadframe on an upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **621** are disposed on a surface of the leadframe without the plastic package material **630** after the laser step. In the singulation step, the package structure **600** is formed. Moreover, a number of the laser step can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0190] In FIG. **32**, when a length of the plastic package material **630** is L, a width of the plastic package material **630** is W, and a maximum protruding length of each of the leads (according to the 6th embodiment, each of the leads is the step-shaped lead **620**) is L2, the following conditions can be satisfied: W≤L, 0.01 W≤L2, and L2≤0.5L. In particular, the plastic package material **630** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the step-shaped leads **620** can be the same. Therefore, the solderable area of the step-shaped leads **620** at the sides of the package structure **600** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **600** soldered on the circuit board (not shown), and the package structure **600** can be firmly disposed on the circuit board.

[0191] In detail, the plating surfaces **621** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **630** can be made of an epoxy resin, but are not limited thereto.

[0192] FIG. **34** is a side view of the package structure **600** according to the 6th embodiment in FIG. **31**. In FIGS. **33** and **34**, a protruding length of a portion of each of the step-shaped leads **620** close to an upper surface **601** of the package structure **600** is smaller than a protruding length of another portion of each of the step-shaped leads **620** close to a lower surface **602** of the package structure **600**. Moreover, the portion of each of the step-shaped leads **620** close to the upper surface **601** of the package structure **600** does not protrude an edge of the plastic package material **630**, and the protruding length of another portion of each of the step-shaped leads **620** close to the lower surface **602** of the package structure **600** is tapered to the protruding length of the portion of each of the step-shaped leads **620** close to the upper surface **601** of the package structure **600**. Furthermore, a protruding width of each of the step-shaped leads **620** is wider, and a thickness of each of the step-shaped leads **620** is thinner, so the burr can be reduced. Further, a concave depth of the concave portion **623** of each of the step-shaped leads **620** can be equal to half of a thickness of another portion of each of the step-shaped leads **620** close to the lower surface **602** of the package structure **600**.

[0193] Moreover, the protruding length of another portion of each of the step-shaped leads **620** close to the lower surface **602** of the package structure **600** protrudes an edge of the plastic package material **630**. Therefore, according to the 6th embodiment, not only can the solderable area of the side of the each of the step-shaped leads **620** be increased, the connection strength between the bottom of the step-shaped leads **620** and the circuit board can also be simultaneously maintained to increase the lifetime of the package structure **600** disposed on the circuit board.

[0194] FIG. **35** is a side view of the package structure **600** after soldering according to the 6th embodiment in FIG. **31**. FIG. **36** is a partial side view of the package structure **600** after soldering according to the 6th embodiment in FIG. **35**. A number of the plating surfaces **621** can be at least four. In FIGS. **33** to **36**, according to the 6th embodiment, the number of the plating surfaces **621** is ten, but is not limited thereto. Further, in FIGS. **35** and **36**, soldering portions **640** of the package structure **600** can be only disposed on the plating surfaces **621**. Therefore, the soldering strength between the package structure **600** and the circuit board is increased when the package structure **600** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the step-shaped leads **620**.

[0195] FIG. **37** is a top view of a package structure **700** according to the 7th embodiment of the present disclosure. FIG. **38** is a bottom view of the package structure **700** according to the 7th embodiment in FIG. **37**. FIG. **39** is a partial schematic view of the package structure **700** according to the 7th embodiment in FIG. **37**. In FIGS. **37** to **39**, the package structure **700** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **730**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **730** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **730** to form the package structure **700**.

[0196] Moreover, the leadframe includes a die pad **710** and a plurality of leads, wherein each of the leads can be a protruding lead **720**, the protruding leads **720** are disposed on four sides of the die pad **710**, and each of the protruding leads **720** includes a plurality of plating surfaces **721** and at least one non-plating surface **722**, wherein the plating surfaces **721** are disposed on each of the protruding leads **720**. The semiconductor die is disposed on the die pad **710** of the leadframe, the plastic package material **730** is disposed on the leadframe, and each of the protruding leads **720** protrudes an outer region of the plastic package material **730**. Therefore, the protruding leads **720** are favorable for enhancing the solderable area of sides of the package structure **700**.

[0197] According to the 7th embodiment, the package structure **700** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step. In the etching step, an upper surface of the leadframe is etched. In the molding step, the plastic package material **730** is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material **730** on an upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **721** are disposed on a surface of the leadframe without the plastic package material **730** after the laser step. In the singulation step, the package structure **700** is formed. Moreover, a number of the laser step can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0198] In FIG. **38**, when a length of the plastic package material **730** is L, a width of the plastic package material **730** is W, and a maximum protruding length of each of the leads (according to the 7th embodiment, each of the leads is the protruding lead **720**) is L2, the following conditions can be satisfied: $W \le L$, $0.01W \le L2$, and $L2 \le 0.5L$. In particular, the plastic package material **730** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the protruding leads **720** can be the same. Therefore, the solderable area of the protruding leads **720** at the sides of the package structure **700** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **700** soldered on the circuit board (not shown), and the package structure **700** can be firmly disposed on the circuit board.

[0199] In detail, the plating surfaces **721** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **730** can be made of an epoxy resin, but are not limited thereto.

[0200] FIG. **40** is a side view of the package structure **700** according to the 7th embodiment in FIG. **37**. In FIGS. **39** and **40**, a protruding length of a portion of each of the protruding leads **720** close to an upper surface **701** of the package structure **700** is smaller than a protruding length of another portion of each of the protruding leads **720** close to a lower surface **702** of the package structure **700**. Furthermore, a protruding width of each of the protruding leads **720** is wider, and a thickness of each of the protruding leads **720** is thinner, so the burr can be reduced.

[0201] In FIG. **38**, not only does the protruding leads **720** protrudes an edge of the plastic package material **730**, each of the protruding leads **720** on the lower surface **702** of the package structure **700** also further includes a portion of the plating surfaces **721**. FIG. **41** is a cross-sectional schematic view of the package structure **700** along a **41-41** line in FIG. **40**. Furthermore, in FIG. **41**, a portion of each of the protruding leads **720** protruding the plastic package material **730** and covered via the plastic package material **730** is like gull-wing shape. Therefore, the protruding leads **720** can be more flexible to increase the reliability of the board level. When the plastic package material **730** covers the package structure **700**, the mechanical strength of the protruding leads **720** can be more robust. When the solderable area of sides of each of the protruding leads **720** is enhanced, the connection strength of the wire bonding between the semiconductor die and the protruding leads **720** can be simultaneously kept.

[0202] FIG. **42** is a side view of the package structure **700** after soldering according to the 7th embodiment in FIG. **37**. FIG. **43** is a partial side view of the package structure **700** after soldering according to the 7th embodiment in FIG. **42**. A number of the plating surfaces **721** can be at least four. In FIGS. **42** to **43**, according to the 7th embodiment, the number of the plating surfaces **721** is seven, but is not limited thereto. Further, in FIGS. **42** and **43**, soldering portions **740** of the package structure **700** can be only disposed on the plating surfaces **721**. Therefore, the soldering strength between the package structure **700** and the circuit board is increased when the package structure **700** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the protruding leads **720**.

[0203] FIG. **44** is a top view of a package structure **800** according to the 8th embodiment of the present disclosure. FIG. **45** is a bottom view of the package structure **800** according to the 8th embodiment in FIG. **44**. FIG. **46** is a partial schematic view of the package structure **800** according to the 8th embodiment in FIG. **44**. In FIGS. **44** to **46**, the package structure **800** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **830**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **830** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **830** to form the package structure **800**.

[0204] Moreover, the leadframe includes a die pad **810** and a plurality of leads, wherein each of the leads can be a step-shaped lead **820**, the step-shaped leads **820** are disposed on four sides of the die pad **810**, and each of the step-shaped leads **820** includes a plurality of plating surfaces **821** and at least one non-plating surface **822**. The semiconductor die is disposed on the die pad **810** of the leadframe, the plastic package material **830** is disposed on the leadframe, and each of the step-shaped leads **820** protrudes an outer region of the plastic package material **830**. Therefore, the step-shaped leads **820** which protrude sides of the package structure **800** are favorable for enhancing the solderable area of the sides of the package structure **800**.

[0205] According to the 8th embodiment, the package structure **800** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step. In the etching step, an upper surface of the leadframe is etched. In the molding step, the plastic package material **830** is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material **830** on an upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **821** are disposed on a surface of the leadframe without the plastic package material **830** after the laser step. In the singulation step, the package structure **800** is formed. Moreover, a number of the laser step can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0206] In FIG. **45**, when a length of the plastic package material **830** is L, a width of the plastic package material **830** is W, and a maximum protruding length of each of the leads (according to the 8th embodiment, each of the leads is the step-shaped lead **820**) is L2, the following conditions can be satisfied: $W \leq L$, $0.01\,W \leq L2$, and $L2 \leq 0.5L$. In particular, the plastic package material **830** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the step-shaped leads **820** can be the same. Therefore, the solderable area of the step-shaped leads **820** at the sides of the package structure **800** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **800** soldered on the circuit board (not shown), and the package structure **800** can be firmly disposed on the circuit board.

[0207] In detail, the plating surfaces **821** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **830** can be made of an epoxy resin, but are not limited thereto.

[0208] FIG. **47** is a side view of the package structure **800** according to the 8th embodiment in FIG. **44**. In FIGS. **46** and **47**, a protruding length of a portion of each of the step-shaped leads **820** close to an upper surface **801** of the package structure **800** is smaller than a protruding length of another portion of each of the step-shaped leads **820** close to a lower surface **802** of the package structure **800**. Furthermore, a protruding width of each of the step-shaped leads **820** is wider, and a thickness of each of the step-shaped leads **820** is thinner, so the burr can be reduced.

[0209] FIG. **48** is a cross-sectional schematic view of the package structure **800** along a **48-48** line in FIG. **47**. Furthermore, in FIG. **48**, a portion of each of the step-shaped leads **820** protruding the plastic package material **830** and covered via the plastic package material **830** is like gull-wing shape. Therefore, the step-shaped leads **820** can be more flexible to increase the reliability of the board level. When the plastic package material **830** covers the package structure **800**, the mechanical strength of the step-shaped leads **820** can be more robust. When the solderable area of sides of each of the step-shaped leads **820** is enhanced, the connection strength of the wire bonding between the semiconductor die and the step-shaped leads **820** can be simultaneously kept.

[0210] FIG. **49** is a side view of the package structure **800** after soldering according to the 8th embodiment in FIG. **44**. FIG. **50** is a partial side view of the package structure **800** after soldering according to the 8th embodiment in FIG. **49**. A number of the plating surfaces **821** can be at least four. In FIGS. **49** to **50**, according to the 8th embodiment, the number of the plating surfaces **821** is six, but is not limited thereto. Further, in FIGS. **49** and **50**, soldering portions **840** of the package structure **800** can be only disposed on the plating surfaces **821**. Therefore, the soldering strength between the package structure **800** and the circuit board is increased when the package structure **800** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the step-shaped leads **820**.

[0211] FIG. **51** is a top view of a package structure **900** according to the 9th embodiment of the present disclosure. FIG. **52** is a bottom view of the package structure **900** according to the 9th embodiment in FIG. **51**. FIG. **53** is a partial schematic view of the package structure **900** according to the 9th embodiment in FIG. **51**. In FIGS. **51** to **53**, the package structure **900** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **930**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **930** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **930** to form the package structure **900**.

[0212] Moreover, the leadframe includes a die pad **910** and a plurality of leads, wherein each of the leads can be a protruding lead **920**, the protruding leads **920** are disposed on four sides of the die pad **910**, and each of the protruding leads **920** includes a plurality of plating surfaces **921** and at least one non-plating surface **922**, wherein the plating surfaces **921** are disposed on each of the protruding leads **920**. The semiconductor die is disposed on the die pad **910** of the leadframe, the plastic package material **930** is disposed on the leadframe, and each of the protruding leads **920** protrudes an outer region of the plastic package material **930**. Therefore, the protruding leads **920** are favorable for enhancing the solderable area of sides of the package structure **900**.

[0213] According to the 9th embodiment, the package structure **900** can be obtained by an etching step, a molding step, two laser steps, a plating step and a singulation step. In the etching step, an upper surface of the leadframe is etched. In the molding step, the plastic package material **930** is disposed on and covers the semiconductor die. In the laser steps, each of a portion of the plastic package material **930** on the upper surface of the leadframe and a portion of the plastic package material **930** on a lower surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **921** are disposed on a surface of the leadframe without the plastic package material **930** after the laser steps. In the singulation step, the package structure **900** is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0214] In FIG. **52**, when a length of the plastic package material **930** is L, a width of the plastic package material **930** is W, and a maximum protruding length of each of the leads (according to the 9th embodiment, each of the leads is the protruding lead **920**) is L2, the following conditions can be satisfied: W≤L, 0.01W≤L2, and L2≤0.5L. In particular, the plastic package material **930** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the protruding leads **920** can be the same. Therefore, the solderable area of the protruding leads **920** at the sides of the package structure **900** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **900** soldered on the circuit board (not shown), and the package structure **900** can be firmly disposed on the circuit board.

[0215] In detail, the plating surfaces **921** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **930** can be made of an epoxy resin, but are not limited thereto.

[0216] FIG. **54** is a side view of the package structure **900** according to the 9th embodiment in FIG. **51**. In FIGS. **53** and **54**, a protruding length of a portion of each of the protruding leads **920** close to an upper surface **901** of the package structure **900** is smaller than a protruding length of another portion of each of the protruding leads **920** close to a lower surface **902** of the package structure **900**. Furthermore, a protruding width of each of the protruding leads **920** is wider, and a thickness of each of the protruding leads **920** is thinner, so the burr can be reduced.

[0217] In FIG. **52**, not only does each of the protruding leads **920** protrudes an edge of the plastic package material **930**, each of the protruding leads **920** on the lower surface **902** of the package structure **900** also further includes a portion of the plating surfaces **921**. FIG. **55** is a cross-sectional schematic view of the package structure **900** along a **55-55** line in FIG. **54**. Furthermore, in FIGS. **53** to **55**, a portion of each of the protruding leads **920** protruding the plastic package material **930** and covered via the plastic package material **930** is like gull-wing shape. Therefore, the protruding leads **920** can be more flexible to increase the reliability of the board level. When the plastic package material **930** covers the package structure **900**, the mechanical strength of the protruding leads **920** can be more robust. When the solderable area of sides of each of the protruding leads **920** is enhanced, the connection strength of the wire bonding between the semiconductor die and the protruding leads **920** can be simultaneously kept.

[0218] FIG. **56** is a side view of the package structure **900** after soldering according to the 9th embodiment in FIG. **51**. FIG. **57** is a partial side view of the package structure **900** after soldering according to the 9th embodiment in FIG. **56**. A number of the plating surfaces **921** can be at least four. In FIGS. **56** to **57**, according to the 9th embodiment, the number of the plating surfaces **921** is nine, but is not limited thereto. Further, in FIGS. **56** and **57**, soldering portions **940** of the package structure **900** can be only disposed on the plating surfaces **921**. Therefore, the soldering strength between the package structure **900** and the circuit board is increased when the package structure **900** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the protruding leads **920**.

[0219] FIG. **58** is a top view of a package structure **1000** according to the 10th embodiment of the present disclosure. FIG. **59** is a bottom view of the package structure **1000** according to the 10th embodiment in FIG. **58**. FIG. **60** is a partial schematic view of the package structure **1000** according to the 10th embodiment in FIG. **58**. In FIGS. **58** to **60**, the package structure **1000** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **1030**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **1030** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **1030** to form the package structure **1000**.

[0220] Moreover, the leadframe includes a die pad **1010** and a plurality of leads, wherein each of the leads can be a protruding lead **1020**, the protruding leads **1020** are disposed on four sides of the die pad **1010**, and each of the protruding leads **1020** includes a plurality of plating surfaces **1021** and at least one non-plating surface **1022**, wherein the plating surfaces **1021** are disposed on each of the protruding leads **1020**. The semiconductor die is disposed on the die pad **1010** of the leadframe, the plastic package material **1030** is disposed on the leadframe, and each of the protruding leads **1020** protrudes an outer region of the plastic package material **1030**. Therefore, the protruding leads **1020** are favorable for enhancing the solderable area of sides of the package structure **1000**.

[0221] According to the 10th embodiment, the package structure **1000** can be obtained by an etching step, a molding step, two laser steps, a plating step and a singulation step. In the etching step, an upper surface of the leadframe is etched. In the molding step, the plastic package material **1030** is disposed on and covers the semiconductor die. In the laser steps, each of a portion of the plastic package material **1030** on the upper surface of the leadframe and a portion of the plastic package material **1030** on a lower surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **1021** are disposed on a surface of the leadframe without the plastic package material **1030** after the laser steps. In the singulation step, the package structure **1000** is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0222] In FIG. **59**, when a length of the plastic package material **1030** is L, a width of the plastic package material **1030** is W, and a maximum protruding length of each of the leads (according to the 10th embodiment, each of the leads is the protruding lead **1020**) is L2, the following conditions can be satisfied: W≤L, 0.01 W≤L2, and L2≤0.5L. In particular, the plastic package material **1030** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the protruding leads **1020** can be the same. Therefore, the solderable area of the protruding leads **1020** at the sides of the package structure **1000** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **1000** soldered on the circuit board (not shown), and the package structure **1000** can be firmly disposed on the circuit board.

[0223] In detail, the plating surfaces **1021** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **1030** can be made of an epoxy resin, but are not limited thereto.

[0224] FIG. **61** is a side view of the package structure **1000** according to the 10th embodiment in FIG. **58**. In FIGS. **60** and **61**, a protruding length of a portion of each of the protruding leads **1020** close to an upper surface **1001** of the package structure **1000** is smaller than a protruding length of another portion of each of the protruding leads **1020** close to a lower surface **1002** of the package structure **1000**. Furthermore, a protruding width of each of the protruding leads **1020** is wider, and a thickness of each of the protruding leads **1020** is thinner, so the burr can be reduced.

[0225] FIG. **62** is a cross-sectional schematic view of the package structure **1000** along a **62-62** line in FIG. **61**. Furthermore, in FIG. **62**, a portion of each of the protruding leads **1020** protruding the plastic package material **1030** and covered via the plastic package material **1030** is like gull-wing shape. Therefore, the protruding leads **1020** can be more flexible to increase the reliability of the board level. When the plastic package material **1030** covers the package structure **1000**, the mechanical strength of the protruding leads **1020** can be more robust. When the solderable area of sides of each of the protruding leads **1020** is enhanced, the connection strength of the wire bonding between the semiconductor die and the protruding leads **1020** can be simultaneously kept.

[0226] FIG. **63** is a side view of the package structure **1000** after soldering according to the 10th embodiment in FIG. **58**. FIG. **64** is a partial side view of the package structure **1000** after soldering according to the 10th embodiment in FIG. **63**. A number of the plating surfaces **1021** can be at least four. In FIGS. **63** to **64**, according to the 10th embodiment, the number of the plating surfaces **1021** is eight, but is not limited thereto. Further, in FIGS. **63** and **64**, soldering portions **1040** of the package structure **1000** can be only disposed on the plating surfaces **1021**. Therefore, the soldering strength between the package structure **1000** and the circuit board is increased when the package structure **1000** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the protruding leads **1020**.

[0227] FIG. **65** is a top view of a package structure **1100** according to the 11th embodiment of the present disclosure. FIG. **66** is a bottom view of the package structure **1100** according to the 11th embodiment in FIG. **65**. FIG. **67** is a partial schematic view of the package structure **1100** according to the 11th embodiment in FIG. **65**. In FIGS. **65** to **67**, the package structure **1100** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **1130**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **1130** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **1130** to form the package structure **1100**.

[0228] Moreover, the leadframe includes a die pad **1110** and a plurality of leads, wherein each of the leads can be a protruding lead **1120**, the protruding leads **1120** are disposed on four sides of the die pad **1110**, and each of the protruding leads **1120** includes a plurality of plating surfaces **1121** and at least one non-plating surface **1122**, wherein the plating surfaces **1121** are disposed on each of the protruding leads **1120**. The semiconductor die is disposed on the die pad **1110** of the leadframe, the plastic package material **1130** is disposed on the leadframe, and each of the protruding leads **1120** protrudes an outer region of the plastic package material **1130**. Therefore, the protruding leads **1120** are favorable for enhancing the solderable area of sides of the package structure **1100**.

[0229] According to the 11th embodiment, the package structure **1100** can be obtained by an etching step, a molding step, two laser steps, a plating step and a singulation step. In the etching step, a lower surface of the leadframe is etched. In the molding step, the plastic package material **1130** is disposed on and covers the semiconductor die. In the laser steps, each of a portion of the plastic package material **1130** on an upper surface of the leadframe and a portion of the plastic package material **1130** on the lower surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **1121** are disposed on a surface of the leadframe without the plastic package material **1130** after the laser steps. In the singulation step, the package structure **1100** is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0230] In FIG. **66**, when a length of the plastic package material **1130** is L, a width of the plastic package material **1130** is W, and a maximum protruding length of each of the leads (according to the 11th embodiment, each of the leads is the protruding lead **1120**) is L2, the following conditions can be satisfied: $W \leq L$, $0.01\,W \leq L2$, and $L2 \leq 0.5L$. In particular, the plastic package material **1130** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the protruding leads **1120** can be the same. Therefore, the solderable area of the protruding leads **1120** at the sides of the package structure **1100** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **1100** soldered on the circuit board (not shown), and the package structure **1100** can be firmly disposed on the circuit board.

[0231] In detail, the plating surfaces **1121** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **1130** can be made of an epoxy resin, but are not limited thereto.

[0232] FIG. **68** is a side view of the package structure **1100** according to the 11th embodiment in FIG. **65**. In FIGS. **67** and **68**, a protruding width of each of the protruding leads **1120** is wider, so the burr can be reduced.

[0233] FIG. **69** is a cross-sectional schematic view of the package structure **1100** along a **69-69** line in FIG. **68**. Furthermore, in FIG. **69**, a portion of each of the protruding leads **1120** protruding the plastic package material **1130** and covered via the plastic package material **1130** is like gull-wing shape. Therefore, the protruding leads **1120** can be more flexible to increase the reliability of the board level.

When the plastic package material **1130** covers the package structure **1100**, the mechanical strength of the protruding leads **1120** can be more robust. When the solderable area of sides of each of the protruding leads **1120** is enhanced, the connection strength of the wire bonding between the semiconductor die and the protruding leads **1120** can be simultaneously kept.

[0234] FIG. **70** is a side view of the package structure **1100** after soldering according to the 11th embodiment in FIG. **65**. FIG. **71** is a partial side view of the package structure **1100** after soldering according to the 11th embodiment in FIG. **70**. A number of the plating surfaces **1121** can be at least four. In FIGS. **70** to **71**, according to the 11th embodiment, the number of the plating surfaces **1121** is six, but is not limited thereto. Further, in FIGS. **70** and **71**, soldering portions **1140** of the package structure **1100** can be only disposed on the plating surfaces **1121**. Therefore, the soldering strength between the package structure **1100** and the circuit board is increased when the package structure **1100** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the protruding leads **1120**.

[0235] FIG. **72** is a top view of a package structure **1200** according to the 12th embodiment of the present disclosure. FIG. **73** is a bottom view of the package structure **1200** according to the 12th embodiment in FIG. **72**. FIG. **74** is a partial schematic view of the package structure **1200** according to the 12th embodiment in FIG. **72**. In FIGS. **72** to **74**, the package structure **1200** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **1230**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **1230** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **1230** to form the package structure **1200**.

[0236] Moreover, the leadframe includes a die pad **1210** and a plurality of leads, wherein each of the leads can be a protruding lead **1220**, the protruding leads **1220** are disposed on four sides of the die pad **1210**, and each of the protruding leads **1220** includes a plurality of plating surfaces **1221** and at least one non-plating surface **1222**, wherein the plating surfaces **1221** are disposed on each of the protruding leads **1220**. The semiconductor die is disposed on the die pad **1210** of the leadframe, the plastic package material **1230** is disposed on the leadframe, and each of the protruding leads **1220** protrudes an outer region of the plastic package material **1230**. Therefore, the protruding leads **1220** are favorable for enhancing the solderable area of sides of the package structure **1200**.

[0237] According to the 12th embodiment, the package structure **1200** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step. In the etching step, a lower surface of the leadframe is etched. In the molding step, the plastic package material **1230** is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material **1230** on an upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **1221** are disposed on a surface of the leadframe without the plastic package material **1230** after the laser steps. In the singulation step, the package structure **1200** is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0238] In FIG. **73**, when a length of the plastic package material **1230** is L, a width of the plastic package material **1230** is W, and a maximum protruding length of each of the leads (according to the 12th embodiment, each of the leads is the protruding lead **1220**) is L2, the following conditions can be satisfied: $W \leq L$, $0.01\ W \leq L2$, and $L2 \leq 0.5L$. In particular, the plastic package material **1230** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the protruding leads **1220** can be the same. Therefore, the solderable area of the protruding leads **1220** at the sides of the package structure **1200** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **1200** soldered on the circuit board (not shown), and the package structure **1200** can be firmly disposed on the circuit board.

[0239] In detail, the plating surfaces **1221** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **1230** can be made of an epoxy resin, but are not limited thereto.

[0240] FIG. **75** is a side view of the package structure **1200** according to the 12th embodiment in FIG. **72**. In FIGS. **74** and **75**, a protruding width of each of the protruding leads **1220** is wider, so the burr can be reduced.

[0241] FIG. **76** is a cross-sectional schematic view of the package structure **1200** along a **76**-**76** line in FIG. **75**. In FIG. **76**, a portion of each of the protruding leads **1220** protruding the plastic package material **1230** and covered via the plastic package material **1230** is like gull-wing shape. Therefore, the protruding leads **1220** can be more flexible to increase the reliability of the board level. When the plastic package material **1230** covers the package structure **1200**, the mechanical strength of the protruding leads **1220** can be more robust. When the solderable area of sides of each of the protruding leads **1220** is enhanced, the connection strength of the wire bonding between the semiconductor die and the protruding leads **1220** can be simultaneously kept.

[0242] FIG. **77** is a side view of the package structure **1200** after soldering according to the 12th embodiment in FIG. **72**. FIG. **78** is a partial side view of the package structure **1200** after soldering according to the 12th embodiment in FIG. **77**. A number of the plating surfaces **1221** can be at least four. In FIGS. **77** to **78**, according to the 12th embodiment, the number of the plating surfaces **1221** is four, but is not limited thereto. Further, in FIGS. **77** and **78**, soldering portions **1240** of the package structure **1200** can be only disposed on the plating surfaces **1221**. Therefore, the soldering strength between the package structure **1200** and the circuit board is increased when the package structure **1200** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the protruding leads **1220**.

[0243] FIG. **79** is a top view of a package structure **1300** according to the 13th embodiment of the present disclosure. FIG. **80** is a bottom view of the package structure **1300** according to the 13th embodiment in FIG. **79**. FIG. **81** is a partial schematic view of the package structure **1300** according to the 13th embodiment in FIG. **79**. In FIGS. **79** to **81**, the package structure **1300** includes a leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **1330**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **1330** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **1330** to form the package structure **1300**.

[0244] Moreover, the leadframe includes a die pad **1310** and a plurality of leads, wherein each of the leads can be a protruding lead **1320**, the protruding leads **1320** are disposed on four sides of the die pad **1310**, and each of the protruding leads **1320** includes a plurality of plating surfaces **1321**, at least one non-plating surface **1322** and a concave portion **1323**, wherein the concave portion **1323** is located on a surface of each of the protruding lead **1320**, and the plating surfaces **1321** are disposed on each of the protruding leads **1320** and the concave portion **1323**. The semiconductor die is disposed on the die pad **1310** of the leadframe, the plastic package material **1330** is disposed on the leadframe, and each of the protruding leads **1320** protrudes an outer region of the plastic package material **1330**. Therefore, the protruding leads **1320** are favorable for enhancing the solderable area of sides of the package structure **1300**.

[0245] According to the 13th embodiment, the package structure **1300** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step. In the etching step, a lower surface of the leadframe is etched. In the molding step, the plastic package material **1330** is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material **1330** on an upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **1321** are disposed on a surface of the leadframe without the plastic package material **1330** after the laser step. In the singulation step, the package structure **1300** is formed. Moreover, a number of the laser step can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0246] In FIG. **80**, when a length of the plastic package material **1330** is L, a width of the plastic package material **1330** is W, and a maximum protruding length of each of the leads (according to the 13th embodiment, each of the leads is the protruding lead **1320**) is L2, the following conditions can be satisfied: W≤L, 0.01 W≤L2, and L2≤0.5L. In particular, the plastic package material **1330** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the protruding leads **1320** can be the same. Therefore, the solderable area of the protruding leads **1320** at the sides of the package structure **1300** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **1300** soldered on the circuit board (not shown), and the package structure **1300** can be firmly disposed on the circuit board.

[0247] In detail, the plating surfaces **1321** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu); the leadframe can be made of an iron-nickel alloy or a copper alloy; the plastic package material **1330** can be made of an epoxy resin, but are not limited thereto.

[0248] FIG. **82** is a side view of the package structure **1300** according to the 13th embodiment in FIG. **79**. In FIGS. **81** and **82**, a protruding width of each of the protruding leads **1320** is wider, so the burr can be reduced. Further, a concave depth of the concave portion **1323** of each of the protruding leads **1320** can be smaller than half of a thickness of the protruding leads **1320**.

[0249] FIG. **83** is a cross-sectional schematic view of the package structure **1300** along an **83-83** line in FIG. **82**. In FIG. **83**, a portion of each of the protruding leads **1320** protruding the plastic package material **1330** and covered via the plastic package material **1330** is like gull-wing shape. Therefore, the protruding leads **1320** can be more flexible to increase the reliability of the board level. When the plastic package material **1330** covers the package structure **1300**, the mechanical strength of the protruding leads **1320** can be more robust. When the solderable area of sides of each of the protruding leads **1320** is enhanced, the connection strength of the wire bonding between the semiconductor die and the protruding leads **1320** can be simultaneously kept.

[0250] FIG. **84** is a side view of the package structure **1300** after soldering according to the 13th embodiment in FIG. **79**. FIG. **85** is a partial side view of the package structure **1300** after soldering according to the 13th embodiment in FIG. **84**. A number of the plating surfaces **1321** can be at least four. In FIGS. **84** to **85**, according to the 13th embodiment, the number of the plating surfaces **1321** is eight, but is not limited thereto. Further, in FIGS. **84** and **85**, soldering portions **1340** of the package structure **1300** can be only disposed on the plating surfaces **1321**. Therefore, the soldering strength between the package structure **1300** and the circuit board is increased when the package structure **1300** is disposed on the circuit board because of the enhancement of the solderable area of the side of each of the protruding leads **1320**.

[0251] In summary, it is favorable for enhancing the solderable area via the package structure of the present disclosure, and the soldering strength between the circuit board and the package structure can be further enhanced. Moreover, the package structure can be firmly disposed on the circuit board after soldering. Therefore, it is favorable for increasing the lifetime of the package structure disposed on the circuit board to enhance the reliability of the board level.

[0252] FIG. **86** is a top view of a package structure **1400** according to the 14th embodiment of the present disclosure. FIG. **87** is a bottom view of the package structure **1400** according to the 14th embodiment in FIG. **86**. FIG. **88** is a partial schematic view of the package structure **1400** according to the 14th embodiment in FIG. **86**. FIG. **89** is a side view of the package structure **1400** according to the 14th embodiment in FIG. **86**. In FIGS. **86** to **89**, the package structure **1400** has an upper surface **1401** and a lower surface **1402**, and includes leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **1430**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **1430** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **1430** to form the package structure **1400**.

[0253] The leadframe includes a die pad **1410** and a plurality of leads **1420**, wherein the semiconductor die is disposed on the die pad **1410** of the leadframe, the leads **1420** are disposed on four peripheral regions of the die pad **1410**, and each of the leads **1420** includes a main body **1421**, at least one extending portion **1422**, a plurality of plating surfaces **1423**, at least one non-plating surface **1424** and a protruding portion **1425**.

[0254] The extending portion **1422** is connected to the main body **1421**, the protruding portion **1425** is connected to the main body **1421**, and the main body **1421**, the extending portion **1422** and the protruding portion **1425** are integrally formed, wherein the plating surfaces **1423** are disposed on the main body **1421**, the extending portion **1422** and the protruding portion **1425**, and the non-plating surface **1424** is disposed on the extending portion **1422**. The main body **1421**, the extending portion **1422** and the protruding portion **1425** of each of the leads **1420** protrude a peripheral region of the plastic package material **1430**, and the main body **1421** and the extending portion **1422** are farther from the lower surface **1402** of the package structure **1400** than the protruding portion **1425** from the lower surface **1402** of the package structure **1400**. Therefore, the leads **1420** which protrude an outer periphery of the plastic package material **1430** are favorable for enhancing the solderable area of sides of the package structure **1400**. Moreover, the thermal cycle life of board level can be enhanced over 20% by the package structure **1400** compared with the package structure, of which the leads do not protrude the outer periphery of the plastic package material, of prior art.

[0255] According to the 14th embodiment, a number of the extending portion **1422** of each of the leads **1420** is two, a number of the plating surfaces **1423** of each of the leads **1420** is nine, a number of the non-plating surface **1424** of each of the leads **1420** is two, and each of the leads **1420** is a step-shaped lead. Furthermore, the plating surfaces **1423** can be made of a tin alloy or a nickel-gold alloy, wherein the nickel-gold alloy can be nickel-palladium-gold (NiPdAu), nickel-palladium-silver-gold (NiPdAgAu) or nickel-gold (NiAu), the leadframe can be made of an iron-nickel alloy or a copper alloy, and the plastic package material **1430** can be made of an epoxy resin, but are not limited thereto.

[0256] According to the 14th embodiment, the package structure **1400** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step, but the present disclosure is not limited thereto. In the etching step, a lower surface of the leadframe is etched. In the molding step, the plastic package material **1430** is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material **1430** on an upper surface and the lower surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **1423** are disposed on a surface of the leadframe without the plastic package material **1430** after the laser steps. In the singulation step, the package structure **1400** is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0257] In FIG. **87**, when a length of the package structure **1400** is L, a width of the package structure **1400** is W, and a maximum protruding length of each of the leads **1420** is Lmax, the following conditions are satisfied: $W \leq L$; $0.01W \leq Lmax$; and $Lmax \leq 0.5L$. In particular, the plastic package material **1430** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the leads **1420** can be the same. Therefore, the solderable area of the leads **1420** at the sides of the package structure **1400** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **1400** soldered on the circuit board (not shown), and the package structure **1400** can be firmly disposed on the circuit board.

[0258] In FIGS. **87** to **89**, when an extending length of the main body **1421** is L1, an extending length of each of the extending portions **1422** is L2, an extending length of the protruding portion **1425** is L3, a width of the main body **1421** is W1, a width of each of the extending portions **1422** is W2, a thickness of each of the leads **1420** is T, the length of the package structure **1400** is L, and the maximum protruding length of each of the leads **1420** is Lmax, the following conditions are satisfied: $0<L2 \leq 0.5L$; $0<L3 \leq 0.5L$; $0.25T \leq W2<W1$; and $0<Lmax=L1+L2$. Therefore, the structural stability of the leads **1420** can be maintained, and the condition of insufficient soldering on sides of the leads is not easily happened so as to enhance the reliability.

[0259] FIG. **90** is a top view of the package structure **1400** after soldering according to the 14th embodiment in FIG. **86**. FIG. **91** is a bottom view of the package structure **1400** after soldering according to the 14th embodiment in FIG. **86**. FIG. **92** is a partial side view of the package structure **1400** after soldering according to the 14th embodiment in FIG. **86**. FIG. **93** is a side view of the package structure **1400** after soldering according to the 14th embodiment in FIG. **86**. FIG. **94** is a partial side view of the package structure **1400** after soldering according to the 14th embodiment in FIG. **93**. In FIGS. **90** to **94**, soldering portions **1440** can be only disposed on the plating surfaces **1423**, wherein the soldering portions **1440** are contacted with the main body **1421**, the extending portions **1422** and the protruding portion **1425**, which the plating surfaces **1423** are disposed on. Therefore, the solderable area of a bottom of the package structure **1400** can be maintained, and the solderable area of the sides of the package structure **1400** can be simultaneously enhanced, so that the soldering strength between the package structure **1400** and the circuit board can be enhanced.

[0260] In FIG. **92**, the inspectors can check the soldering condition from a detecting direction D via an automated optical inspection (AOI) after the soldering process of the package structure **1400**. In particular, the detecting direction D is a direction from the upper surface **1401** to the lower surface **1402** of the package structure **1400**, and the inspectors can directly check the soldering condition from a top-down perspective. By operating the AOI from the top-down perspective, the detecting efficiency can be enhanced.

[0261] It should be mentioned that the disposing position of the soldering portion **1440** in FIGS. **90** to **94** is only configured to illustrate that the soldering portion **1440** is only disposed on the plating surfaces **1423** rather than the non-plating surfaces **1424**, but the disposing position of the soldering portion **1440** is not limited to FIGS. **90** to **94**.

[0262] FIG. **95** is a top view of a package structure **1500** according to the 15th embodiment of the present disclosure. FIG. **96** is a bottom view of the package structure **1500** according to the 15th embodiment in FIG. **95**. FIG. **97** is a partial schematic view of the package structure **1500** according to the 15th embodiment in FIG. **95**. FIG. **98** is a side view of the package structure **1500** according to the 15th embodiment in FIG. **95**. In FIGS. **95** to **98**, the package structure **1500** has an upper surface **1501** and a lower surface **1502**, and includes leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **1530**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **1530** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **1530** to form the package structure **1500**.

[0263] The leadframe includes a die pad **1510** and a plurality of leads **1520**, wherein the semiconductor die is disposed on the die pad **1510** of the leadframe, the leads **1520** are disposed on four peripheral regions of the die pad **1510**, and each of the leads **1520** includes a main body **1521**, at least one extending portion **1522**, a plurality of plating surfaces **1523**, at least one non-plating surface **1524** and a plane portion **1526**.

[0264] The extending portion **1522** is connected to the main body **1521**, the plane portion **1526** is connected to the main body **1521**, and the main body **1521**, the extending portion **1522** and the plane portion **1526** are integrally formed, wherein the plating surfaces **1523** are disposed on the main body **1521**, the extending portion **1522** and the plane portion **1526**, and the non-plating surface **1524** is disposed on the extending portion **1522**. The main body **1521** and the extending portion **1522** of each of the leads **1520** protrude a peripheral region of the plastic package material **1530**, and the main body **1521** and the extending portion **1522** are farther from the lower surface **1502** of the package structure **1500** than the plane portion **1526** from the lower surface **1502** of the package structure **1500**. Therefore, the leads **1520** which protrude an outer periphery of the plastic package material **1530** are favorable for enhancing the solderable area of sides of the package structure **1500**. Moreover, the thermal cycle life of board level can be enhanced over 20% by the package structure **1500** compared with the package structure, of which the leads do not protrude the outer periphery of the plastic package material, of prior art.

[0265] According to the 15th embodiment, a number of the extending portion **1522** of each of the leads **1520** is one, a number of the plating surfaces **1523** of each of the leads **1520** is ten, a number of the non-plating surface **1524** of each of the leads **1520** is one, and each of the leads **1520** is a step-shaped lead.

[0266] According to the 15th embodiment, the package structure **1500** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step, but the present disclosure is not limited thereto. In the etching step, a lower surface of the leadframe is etched. In the molding step, the plastic package material **1530** is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material **1530** on an upper surface and the lower surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **1523** are disposed on a surface of the leadframe without the plastic package material **1530** after the laser steps. In the singulation step, the package structure **1500** is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0267] In FIG. **96**, when a length of the package structure **1500** is L, a width of the package structure **1500** is W, and a maximum protruding length of each of the leads **1520** is Lmax, the following conditions are satisfied: $W \leq L$; $0.01 W \leq Lmax$; and $Lmax \leq 0.5L$. In particular, the plastic package material **1530** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the leads **1520** can be the same. Therefore, the solderable area of the leads **1520** at the sides of the package structure **1500** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **1500** soldered on the circuit board (not shown), and the package structure **1500** can be firmly disposed on the circuit board.

[0268] In FIGS. **96** to **98**, when an extending length of the main body **1521** is L1, an extending length of the extending portion **1522** is L2, a width of the main body **1521** is W1, a width of the extending portion **1522** is W2, a thickness of each of the leads **1520** is T, the length of the package structure **1500** is L, and the maximum protruding length of each of the leads **1520** is Lmax, the following conditions are satisfied: $0 < L2 \leq 0.5L$; $0.25T \leq W2 < W1$; and $0 < Lmax = L1 + L2$. Therefore, the structural stability of the leads **1520** can be maintained, and the condition of insufficient soldering on sides of the leads is not easily happened.

[0269] Moreover, the portion of each of the leads **1520** close to the lower surface **1502** of the package structure **1500** does not protrude an edge of the plastic package material **1530**. Therefore, according to the 15th embodiment, the POD does not need to be changed, and the process of redrawing the POD can be reduced.

[0270] FIG. **99** is a top view of the package structure **1500** after soldering according to the 15th embodiment in FIG. **95**. FIG. **100** is a bottom view of the package structure **1500** after soldering according to the 15th embodiment in FIG. **95**. FIG. **101** is a partial side view of the package structure **1500** after soldering according to the 15th embodiment in FIG. **95**. FIG. **102** is a side view of the package structure **1500** after soldering according to the 15th embodiment in FIG. **95**. FIG. **103** is a partial side view of the package structure **1500** after soldering according to the 15th embodiment in FIG. **102**. In FIGS. **99** to **103**, soldering portions **1540** can be only disposed on the plating surfaces **1523**, wherein the soldering portions **1540** are contacted with the main body **1521**, the extending portion **1522** and the plane portion **1526**, which the plating surfaces **1523** are disposed on. Therefore, the solderable area of a bottom of the package structure **1500** can be maintained, and the solderable area of the sides of the package structure **1500** can be simultaneously enhanced, so that the soldering strength between the package structure **1500** and the circuit board can be enhanced.

[0271] In FIG. **101**, the inspectors can check the soldering condition from a detecting direction D via an AOI after the soldering process of the package structure **1500**. In particular, the detecting direction D is a direction from the upper surface **1501** to the lower surface **1502** of the package structure **1500**, and the inspectors can directly check the soldering condition from a top-down perspective. By operating the AOI from the top-down perspective, the detecting efficiency can be enhanced.

[0272] Further, all of other structures and dispositions according to the 15th embodiment are the same as the structures and the dispositions according to the 14th embodiment, and will not be described again herein.

[0273] FIG. **104** is a top view of a package structure **1600** according to the 16th embodiment of the present disclosure. FIG. **105** is a bottom view of the package structure **1600** according to the 16th embodiment in FIG. **104**. FIG. **106** is a partial schematic view of the package structure **1600** according to the 16th embodiment in FIG. **104**. FIG. **107** is a side view of the package structure **1600** according to the 16th embodiment in FIG. **104**. In FIGS. **104** to **107**, the package structure **1600** has an upper surface **1601** and a lower surface **1602**, and includes leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **1630**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **1630** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **1630** to form the package structure **1600**.

[0274] The leadframe includes a die pad **1610** and a plurality of leads **1620**, wherein the semiconductor die is disposed on the die pad **1610** of the leadframe, the leads **1620** are disposed on four peripheral regions of the die pad **1610**, and each of the leads **1620** includes a main body **1621**, at least one extending portion **1622**, a plurality of plating surfaces **1623** and at least one non-plating surface **1624**.

[0275] The extending portion **1622** is connected to the main body **1621**, and the main body **1621** and the extending portion **1622** are integrally formed, wherein the plating surfaces **1623** are disposed on the main body **1621** and the extending portion **1622**, and the non-plating surface **1624** is disposed on the extending portion **1622**. The main body **1621** and the extending portion **1622** of each of the leads **1620** protrude a peripheral region of the plastic package material **1630**. Therefore, the leads **1620** which protrude an outer periphery of the plastic package material **1630** are favorable for enhancing the solderable area of sides of the package structure **1600**. Moreover, the thermal cycle life of board level can be enhanced over 20% by the package structure **1600** compared with the package structure, of which the leads do not protrude the outer periphery of the plastic package material, of prior art.

[0276] According to the 16th embodiment, a number of the extending portion **1622** of each of the leads **1620** is one, a number of the plating surfaces **1623** of each of the leads **1620** is eight, a number of the non-plating surface **1624** of each of the leads **1620** is one, and each of the leads **1620** is a protruding lead.

[0277] According to the 16th embodiment, the package structure **1600** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step, but the present disclosure is not limited thereto. In the etching step, a lower surface of the leadframe is etched. In the molding step, the plastic package material **1630** is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material **1630** on an upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **1623** are disposed on a surface of the leadframe without the plastic package material **1630** after the laser steps. In the singulation step, the package structure **1600** is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0278] In FIG. **105**, when a length of the package structure **1600** is L, a width of the package structure **1600** is W, and a maximum protruding length of each of the leads **1620** is Lmax, the following conditions are satisfied: $W \leq L$; $0.01 W \leq Lmax$; and $Lmax \leq 0.5L$. In particular, the plastic package material **1630** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the leads **1620** can be the same. Therefore, the solderable area of the leads **1620** at the sides of the package structure **1600** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **1600** soldered on the circuit board (not shown), and the package structure **1600** can be firmly disposed on the circuit board.

[0279] In FIGS. **106** and **107**, when a width of the main body **1621** is W1, a width of the extending portion **1622** is W2, and a thickness of each of the leads **1620** is T, the following condition is satisfied: $0.25T \leq W2 < W1$. Therefore, the structural stability of the leads **1620** can be maintained, and the condition of insufficient soldering on sides of the leads is not easily happened.

[0280] FIG. **108** is a top view of the package structure **1600** after soldering according to the 16th embodiment in FIG. **104**. FIG. **109** is a bottom view of the package structure **1600** after soldering according to the 16th embodiment in FIG. **104**. FIG. **110** is a partial side view of the package structure **1600** after soldering according to the 16th embodiment in FIG. **104**. FIG. **111** is a side view of the package structure **1600** after soldering according to the 16th embodiment in FIG. **104**. FIG. **112** is a partial side view of the package structure **1600** after soldering according to the 16th embodiment in FIG. **111**. In FIGS. **108** to **112**, soldering portions **1640** can be only disposed on the plating surfaces **1623**, wherein the soldering portions **1640** are contacted with the main body **1621** and the extending portion **1622**, which the plating surfaces **1623** are disposed on. Therefore, the solderable area of a bottom of the package structure **1600** can be maintained, and the solderable area of the sides of the package structure **1600** can be simultaneously enhanced, so that the soldering strength between the package structure **1600** and the circuit board can be enhanced.

[0281] In FIG. **110**, the inspectors can check the soldering condition from a detecting direction D via an AOI after the soldering process of the package structure **1600**. In particular, the detecting direction D is a direction from the upper surface **1601** to the lower surface **1602** of the package structure **1600**, and the inspectors can directly check the soldering condition from a top-down perspective. By operating the AOI from the top-down perspective, the detecting efficiency can be enhanced.

[0282] Further, all of other structures and dispositions according to the 16th embodiment are the same as the structures and the dispositions according to the 14th embodiment, and will not be described again herein.

[0283] FIG. **113** is a top view of a package structure **1700** according to the 17th embodiment of the present disclosure. FIG. **114** is a bottom view of the package structure **1700** according to the 17th embodiment in FIG. **113**. FIG. **115** is a partial schematic view of the package structure **1700** according to the 17th embodiment in FIG. **113**. FIG. **116** is a side view of the package structure **1700** according to the 17th embodiment in FIG. **113**. In FIGS. **113** to **116**, the package structure **1700** has an upper surface **1701** and a lower surface **1702**, and includes leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material **1730**, wherein the leadframe is for carrying the semiconductor die, the plastic package material **1730** is disposed on the leadframe, and the semiconductor die is covered via the plastic package material **1730** to form the package structure **1700**.

[0284] The leadframe includes a die pad **1710** and a plurality of leads **1720**, wherein the semiconductor die is disposed on the die pad **1710** of the leadframe, the leads **1720** are disposed on four peripheral regions of the die pad

1710, and each of the leads 1720 includes a main body 1721, at least one extending portion 1722, a plurality of plating surfaces 1723, at least one non-plating surface 1724 and a protruding portion 1725.

[0285] The extending portion 1722 is connected to the main body 1721, the protruding portion 1725 is connected to the main body 1721, and the main body 1721, the extending portion 1722 and the protruding portion 1725 are integrally formed, wherein the plating surfaces 1723 are disposed on the main body 1721, the extending portion 1722 and the protruding portion 1725, and the non-plating surface 1724 is disposed on the extending portion 1722. The main body 1721, the extending portion 1722 and the protruding portion 1725 of each of the leads 1720 protrude a peripheral region of the plastic package material 1730, and the main body 1721 and the extending portion 1722 are closer to the lower surface 1702 of the package structure 1700 than the protruding portion 1725 to the lower surface 1702 of the package structure 1700. Therefore, the leads 1720 which protrude an outer periphery of the plastic package material 1730 are favorable for enhancing the solderable area of sides of the package structure 1700. Moreover, the thermal cycle life of board level can be enhanced over 20% by the package structure 1700 compared with the package structure, of which the leads do not protrude the outer periphery of the plastic package material, of prior art.

[0286] According to the 17th embodiment, a number of the extending portion 1722 of each of the leads 1720 is two, a number of the plating surfaces 1723 of each of the leads 1720 is nine, a number of the non-plating surface 1724 of each of the leads 1720 is two, and each of the leads 1720 is a step-shaped lead.

[0287] According to the 17th embodiment, the package structure 1700 can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step, but the present disclosure is not limited thereto. In the etching step, an upper surface of the leadframe is etched. In the molding step, the plastic package material 1730 is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material 1730 on the upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces 1723 are disposed on a surface of the leadframe without the plastic package material 1730 after the laser steps. In the singulation step, the package structure 1700 is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0288] In FIG. 114, when a length of the package structure 1700 is L, a width of the package structure 1700 is W, and a maximum protruding length of each of the leads 1720 is Lmax, the following conditions are satisfied: $W \leq L$; $0.01 W \leq Lmax$; and $Lmax \leq 0.5L$. In particular, the plastic package material 1730 can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the leads 1720 can be the same. Therefore, the solderable area of the leads 1720 at the sides of the package structure 1700 can be consistent. Moreover, the soldering difference is less easily generated when the package structure 1700 soldered on the circuit board (not shown), and the package structure 1700 can be firmly disposed on the circuit board.

[0289] In FIGS. 114 to 116, when the length of the package structure 1700 is L, an extending length of the protruding portion 1725 is L3, a width of the main body 1721 is W1, a width of each of the extending portions 1722 is W2, and a thickness of each of the leads 1720 is T, the following conditions are satisfied: $0<L3 \leq 0.5L$; and $0.25T \leq W2<W1$. Therefore, the structural stability of the leads 1720 can be maintained, and the condition of insufficient soldering on sides of the leads is not easily happened so as to enhance the reliability.

[0290] FIG. 117 is a top view of the package structure 1700 after soldering according to the 17th embodiment in FIG. 113. FIG. 118 is a bottom view of the package structure 1700 after soldering according to the 17th embodiment in FIG. 113. FIG. 119 is a partial side view of the package structure 1700 after soldering according to the 17th embodiment in FIG. 113. FIG. 120 is a side view of the package structure 1700 after soldering according to the 17th embodiment in FIG. 113. FIG. 121 is a partial side view of the package structure 1700 after soldering according to the 17th embodiment in FIG. 120. In FIGS. 117 to 121, soldering portions 1740 can be only disposed on the plating surfaces 1723, wherein the soldering portions 1740 are contacted with the main body 1721, the extending portions 1722 and the protruding portion 1725, which the plating surfaces 1723 are disposed on. Therefore, the solderable area of a bottom of the package structure 1700 can be maintained, and the solderable area of the sides of the package structure 1700 can be simultaneously enhanced, so that the soldering strength between the package structure 1700 and the circuit board can be enhanced.

[0291] In FIG. 119, the inspectors can check the soldering condition from a detecting direction D via an AOI after the soldering process of the package structure 1700. In particular, the detecting direction D is a direction from the upper surface 1701 to the lower surface 1702 of the package structure 1700, and the inspectors can directly check the soldering condition from a top-down perspective. By operating the AOI from the top-down perspective, the detecting efficiency can be enhanced.

[0292] Further, all of other structures and dispositions according to the 17th embodiment are the same as the structures and the dispositions according to the 14th embodiment, and will not be described again herein.

[0293] FIG. 122 is a top view of a package structure 1800 according to the 18th embodiment of the present disclosure. FIG. 123 is a bottom view of the package structure 1800 according to the 18th embodiment in FIG. 122. FIG. 124 is a partial schematic view of the package structure 1800 according to the 18th embodiment in FIG. 122. FIG. 125 is a side view of the package structure 1800 according to the 18th embodiment in FIG. 122. In FIGS. 122 to 125, the package structure 1800 has an upper surface 1801 and a lower surface 1802, and includes leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material 1830, wherein the leadframe is for carrying the semiconductor die, the plastic package material 1830 is disposed on the leadframe, and the semiconductor die is covered via the plastic package material 1830 to form the package structure 1800.

[0294] The leadframe includes a die pad 1810 and a plurality of leads 1820, wherein the semiconductor die is disposed on the die pad 1810 of the leadframe, the leads 1820 are disposed on four peripheral regions of the die pad

1810, and each of the leads 1820 includes a main body 1821, at least one extending portion 1822, a plurality of plating surfaces 1823, at least one non-plating surface 1824 and a plane portion 1826.

[0295] The extending portion 1822 is connected to the main body 1821, the plane portion 1826 is connected to the main body 1821, and the main body 1821, the extending portion 1822 and the plane portion 1826 are integrally formed, wherein the plating surfaces 1823 are disposed on the main body 1821, the extending portion 1822 and the plane portion 1826, and the non-plating surface 1824 is disposed on the extending portion 1822. The main body 1821 and the extending portion 1822 of each of the leads 1820 protrude a peripheral region of the plastic package material 1830, and the main body 1821 and the extending portion 1822 are closer to the lower surface 1802 of the package structure 1800 than the plane portion 1826 to the lower surface 1802 of the package structure 1800. Therefore, the leads 1820 which protrude an outer periphery of the plastic package material 1830 are favorable for enhancing the solderable area of sides of the package structure 1800. Moreover, the thermal cycle life of board level can be enhanced over 20% by the package structure 1800 compared with the package structure, of which the leads do not protrude the outer periphery of the plastic package material, of prior art.

[0296] According to the 18th embodiment, a number of the extending portion 1822 of each of the leads 1820 is one, a number of the plating surfaces 1823 of each of the leads 1820 is nine, a number of the non-plating surface 1824 of each of the leads 1820 is one, and each of the leads 1820 is a step-shaped lead.

[0297] According to the 18th embodiment, the package structure 1800 can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step, but the present disclosure is not limited thereto. In the etching step, an upper surface of the leadframe is etched. In the molding step, the plastic package material 1830 is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material 1830 on the upper surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces 1823 are disposed on a surface of the leadframe without the plastic package material 1830 after the laser steps. In the singulation step, the package structure 1800 is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0298] In FIG. 123, when a length of the package structure 1800 is L, a width of the package structure 1800 is W, and a maximum protruding length of each of the leads 1820 is Lmax, the following conditions are satisfied: $W \leq L$; $0.01 W \leq Lmax$; and $Lmax \leq 0.5L$. In particular, the plastic package material 1830 can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the leads 1820 can be the same. Therefore, the solderable area of the leads 1820 at the sides of the package structure 1800 can be consistent. Moreover, the soldering difference is less easily generated when the package structure 1800 soldered on the circuit board (not shown), and the package structure 1800 can be firmly disposed on the circuit board.

[0299] In FIGS. 124 and 125, when a width of the main body 1821 is W1, a width of the extending portion 1822 is W2, and a thickness of each of the leads 1820 is T, the following condition is satisfied: $0.25T \leq W2 < W1$. Therefore, the structural stability of the leads 1820 can be maintained, and the condition of insufficient soldering on sides of the leads is not easily happened.

[0300] FIG. 126 is a top view of the package structure 1800 after soldering according to the 18th embodiment in FIG. 122. FIG. 127 is a bottom view of the package structure 1800 after soldering according to the 18th embodiment in FIG. 122. FIG. 128 is a partial side view of the package structure 1800 after soldering according to the 18th embodiment in FIG. 122. FIG. 129 is a side view of the package structure 1800 after soldering according to the 18th embodiment in FIG. 122. FIG. 130 is a partial side view of the package structure 1800 after soldering according to the 18th embodiment in FIG. 129. In FIGS. 126 to 130, soldering portions 1840 can be only disposed on the plating surfaces 1823, wherein the soldering portions 1840 are contacted with the main body 1821, the extending portion 1822 and the plane portion 1826, which the plating surfaces 1823 are disposed on. Therefore, the solderable area of a bottom of the package structure 1800 can be maintained, and the solderable area of the sides of the package structure 1800 can be simultaneously enhanced, so that the soldering strength between the package structure 1800 and the circuit board can be enhanced.

[0301] In FIG. 128, the inspectors can check the soldering condition from a detecting direction D via an AOI after the soldering process of the package structure 1800. In particular, the detecting direction D is a direction from the upper surface 1801 to the lower surface 1802 of the package structure 1800, and the inspectors can directly check the soldering condition from a top-down perspective. By operating the AOI from the top-down perspective, the detecting efficiency can be enhanced.

[0302] Further, all of other structures and dispositions according to the 18th embodiment are the same as the structures and the dispositions according to the 14th embodiment, and will not be described again herein.

[0303] FIG. 131 is a top view of a package structure 1900 according to the 19th embodiment of the present disclosure. FIG. 132 is a bottom view of the package structure 1900 according to the 19th embodiment in FIG. 131. FIG. 133 is a partial schematic view of the package structure 1900 according to the 19th embodiment in FIG. 131. FIG. 134 is a side view of the package structure 1900 according to the 19th embodiment in FIG. 131. In FIGS. 131 to 134, the package structure 1900 has an upper surface 1901 and a lower surface 1902, and includes leadframe (its reference numeral is omitted), a semiconductor die (not shown) and a plastic package material 1930, wherein the leadframe is for carrying the semiconductor die, the plastic package material 1930 is disposed on the leadframe, and the semiconductor die is covered via the plastic package material 1930 to form the package structure 1900.

[0304] The leadframe includes a die pad 1910 and a plurality of leads 1920, wherein the semiconductor die is disposed on the die pad 1910 of the leadframe, the leads 1920 are disposed on four peripheral regions of the die pad 1910, and each of the leads 1920 includes a main body 1921, at least one extending portion **1922**, a plurality of plating surfaces **1923**, at least one non-plating surface **1924** and a plane portion **1926**.

[0305] The extending portion **1922** is connected to the main body **1921**, the plane portion **1926** is connected to the main body **1921**, and the main body **1921**, the extending portion **1922** and the plane portion **1926** are integrally formed, wherein the plating surfaces **1923** are disposed on the main body **1921**, the extending portion **1922** and the plane portion **1926**, and the non-plating surface **1924** is disposed on the extending portion **1922**. The main body **1921** of each of the leads **1920** is aligned to a peripheral region of the plastic package material **1930**, the extending portion **1922** of each of the leads **1920** protrudes the peripheral region of the plastic package material **1930**, and the main body **1921** and the extending portion **1922** are farther from the lower surface **1902** of the package structure **1900** than the plane portion **1926** from the lower surface **1902** of the package structure **1900**. Therefore, the leads **1920** which protrude an outer periphery of the plastic package material **1930** are favorable for enhancing the solderable area of sides of the package structure **1900**. Moreover, the thermal cycle life of board level can be enhanced over 20% by the package structure **1900** compared with the package structure, of which the leads do not protrude the outer periphery of the plastic package material, of prior art. It should be mentioned that the condition that the main body **1921** is aligned to the peripheral region of the plastic package material **1930** means that the main body **1921** does not protrude the outer periphery of the plastic package material **1930**.

[0306] According to the 19th embodiment, a number of the extending portion **1922** of each of the leads **1920** is two, a number of the plating surfaces **1923** of each of the leads **1920** is ten, a number of the non-plating surface **1924** of each of the leads **1920** is two, and each of the leads **1920** is a protruding lead.

[0307] According to the 19th embodiment, the package structure **1900** can be obtained by an etching step, a molding step, a laser step, a plating step and a singulation step, but the present disclosure is not limited thereto. In the etching step, a lower surface of the leadframe is etched. In the molding step, the plastic package material **1930** is disposed on and covers the semiconductor die. In the laser step, a portion of the plastic package material **1930** on an upper surface and the lower surface of the leadframe is removed via a laser beam. In the plating step, the plating surfaces **1923** are disposed on a surface of the leadframe without the plastic package material **1930** after the laser steps. In the singulation step, the package structure **1900** is formed. Moreover, a number of the laser steps can be more than two, and it depends on the energy and the parameters of the laser beam, but the aforementioned steps are not limited.

[0308] In FIG. **132**, when a length of the package structure **1900** is L, a width of the package structure **1900** is W, and a maximum protruding length of each of the leads **1920** is Lmax, the following conditions are satisfied: $W \leq L$; $0.01W \leq Lmax$; and $Lmax \leq 0.5L$. In particular, the plastic package material **1930** can be square or rectangle, and the maximum protruding length depends on the disposition of the circuit board, and is not limited thereto. Further, the maximum protruding lengths of the leads **1920** can be the same. Therefore, the solderable area of the leads **1920** at the sides of the package structure **1900** can be consistent. Moreover, the soldering difference is less easily generated when the package structure **1900** soldered on the circuit board (not shown), and the package structure **1900** can be firmly disposed on the circuit board.

[0309] Moreover, the portion of each of the leads **1920** close to the lower surface **1902** of the package structure **1900** does not protrude an edge of the plastic package material **1930**. Therefore, according to the 19th embodiment, the POD does not need to be changed, and the process of redrawing the POD can be reduced.

[0310] FIG. **135** is a top view of the package structure **1900** after soldering according to the 19th embodiment in FIG. **131**. FIG. **136** is a bottom view of the package structure **1900** after soldering according to the 19th embodiment in FIG. **131**. FIG. **137** is a partial side view of the package structure **1900** after soldering according to the 19th embodiment in FIG. **131**. FIG. **138** is a side view of the package structure **1900** after soldering according to the 19th embodiment in FIG. **131**. FIG. **139** is a partial side view of the package structure **1900** after soldering according to the 19th embodiment in FIG. **138**. In FIGS. **135** to **139**, soldering portions **1940** can be only disposed on the plating surfaces **1923**, wherein the soldering portions **1940** are contacted with the main body **1921**, the extending portions **1922** and the plane portion **1926**, which the plating surfaces **1923** are disposed on. Therefore, the solderable area of a bottom of the package structure **1900** can be maintained, and the solderable area of the sides of the package structure **1900** can be simultaneously enhanced, so that the soldering strength between the package structure **1900** and the circuit board can be enhanced.

[0311] In FIG. **137**, the inspectors can check the soldering condition from a detecting direction D via an AOI after the soldering process of the package structure **1900**. In particular, the detecting direction D is a direction from the upper surface **1901** to the lower surface **1902** of the package structure **1900**, and the inspectors can directly check the soldering condition from a top-down perspective. By operating the AOI from the top-down perspective, the detecting efficiency can be enhanced.

[0312] Further, all of other structures and dispositions according to the 19th embodiment are the same as the structures and the dispositions according to the 14th embodiment, and will not be described again herein.

[0313] In summary, according to the 14th to 19th embodiments, it is further favorable for enhancing the solderable area on the bottom via the package structure of the present disclosure, and the solderable area of the sides of the package structure can be simultaneously enhanced, so that the soldering strength between the package structure and the circuit board can be enhanced. Further, the package structure can be firmly disposed on the circuit board after soldering so as to enhance the thermal cycle life of board level. Moreover, the detecting efficiency can be enhanced during the detecting process after the soldering process.

[0314] The foregoing description, for purpose of explanation, has been described with reference to specific examples. It is to be noted that Tables show different data of the different examples; however, the data of the different examples are obtained from experiments. The examples were chosen and described in order to best explain the principles of the disclosure and its practical applications, to thereby enable others skilled in the art to best utilize the disclosure and various examples with various modifications as are suited to the particular use contemplated. The examples depicted above and the appended drawings are exemplary and are not intended to be exhaustive or to limit the scope of the present disclosure to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings.

What is claimed is:

1. A package structure, comprising:

a leadframe, comprising:

a die pad; and

a plurality of leads disposed on four peripheral regions of the die pad, and each of the leads comprising:

a main body;

at least one extending portion connected to the main body, and the main body and the at least one extending portion integrally formed;

a plurality of plating surfaces disposed on the main body and the at least one extending portion; and

a protruding portion connected to the main body, wherein the main body, the at least one extending portion and the protruding portion are integrally formed, and the plating surfaces are disposed on the protruding portion;

a semiconductor die disposed on the die pad of the leadframe; and

a plastic package material disposed on the leadframe;

wherein the main body and the at least one extending portion of each of the leads protrude a peripheral region of the plastic package material;

wherein the main body and the at least one extending portion are closer to a lower surface of the package structure than the protruding portion to the lower surface of the package structure.

2. The package structure of claim **1**, wherein each of the leads further comprises at least one non-plating surface, and the at least one non-plating surface is disposed on the at least one extending portion.

3. The package structure of claim **1**, wherein a length of the package structure is L, a width of the package structure is W, a maximum protruding length of each of the leads is Lmax, and the following conditions are satisfied:

$$W \leq L;$$

$$0.01W \leq L\text{max}; \text{ and}$$

$$L\text{max} \leq 0.5L.$$

4. The package structure of claim **1**, wherein a width of the main body is W1, a width of the at least one extending portion is W2, a thickness of each of the leads is T, and the following condition is satisfied:

$$0.25T \leq W2 < W1.$$

5. The package structure of claim **1**, wherein a number of the plating surfaces is at least eight.

6. A package structure, comprising:

a leadframe, comprising:

a die pad; and

a plurality of leads disposed on four peripheral regions of the die pad, and each of the leads comprising:

a main body;

at least one extending portion connected to the main body, and the main body and the at least one extending portion integrally formed;

a plurality of plating surfaces disposed on the main body and the at least one extending portion; and

a plane portion connected to the main body, wherein the main body, the at least one extending portion and the plane portion are integrally formed, and the plating surfaces are disposed on the plane portion;

a semiconductor die disposed on the die pad of the leadframe; and

a plastic package material disposed on the leadframe;

wherein the main body and the at least one extending portion of each of the leads protrude a peripheral region of the plastic package material.

7. The package structure of claim **6**, wherein the main body and the at least one extending portion are farther from a lower surface of the package structure than the plane portion from the lower surface of the package structure.

8. The package structure of claim **7**, wherein an extending length of the main body is L1, an extending length of the at least one extending portion is L2, a maximum protruding length of each of the leads is Lmax, a length of the package structure is L, and the following conditions are satisfied:

$$0 < L2 \leq 0.5L; \text{ and}$$

$$0 < L\text{max} = L1 + L2.$$

9. The package structure of claim **6**, wherein the main body and the at least one extending portion are closer to a lower surface of the package structure than the plane portion to the lower surface of the package structure.

10. A package structure, comprising:

a leadframe, comprising:

a die pad; and

a plurality of leads disposed on four peripheral regions of the die pad, and each of the leads comprising:

a main body;

at least one extending portion connected to the main body, and the main body and the at least one extending portion integrally formed; and

a plurality of plating surfaces disposed on the main body and the at least one extending portion;

a semiconductor die disposed on the die pad of the leadframe; and

a plastic package material disposed on the leadframe;

wherein the main body of each of the leads is aligned to a peripheral region of the plastic package material, and the at least one extending portion of each of the leads protrudes the peripheral region of the plastic package material.

11. The package structure of claim **10**, wherein each of the leads further comprises a plane portion connected to the main body, the main body, the at least one extending portion and the plane portion are integrally formed, and the plating surfaces are disposed on the plane portion.

12. The package structure of claim **10**, wherein a length of the package structure is L, a width of the package structure is W, a maximum protruding length of each of the leads is Lmax, and the following conditions are satisfied:

$$W \leq L;$$

$$0.01W \leq L\text{max}; \text{ and}$$

$$L\text{max} \leq 0.5L.$$

* * * * *