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(54) **SEMICONDUCTOR PACKAGE HAVING PARTIALLY PLATED LEAD FLANK AND METHOD OF MAKING THE SAME**

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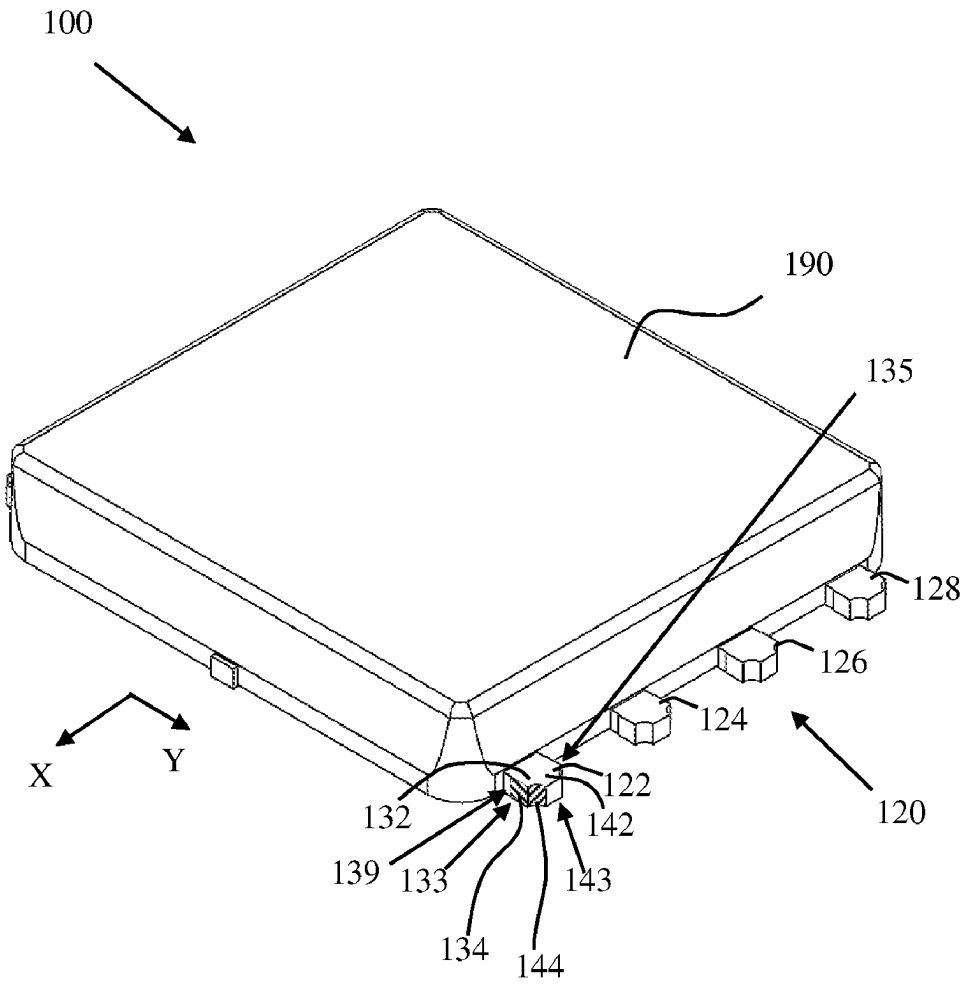
(57) **ABSTRACT**

A semiconductor package comprises a lead frame, a chip, and a molding encapsulation. The lead frame comprises one or more die paddles and a plurality of leads. Each of the plurality of leads comprises a base member and a protrusion member. A width of an end surface of the protrusion member of each of the plurality of leads is less than 50% of a width of a corresponding base member so as to improve solderability. A method, for fabricating semiconductor packages, comprises the steps of providing a lead frame array, mounting a chip, forming a molding encapsulation, applying a cutting process or a punching process, applying a plating process, and applying a singulation process.



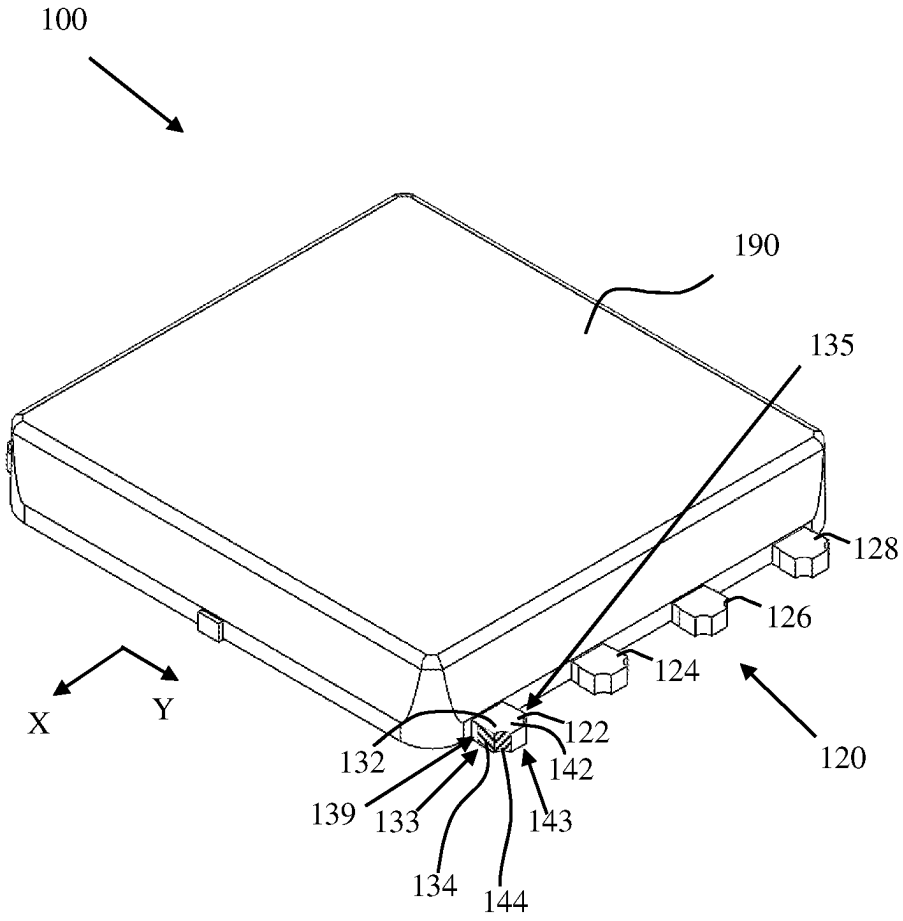


FIG. 1

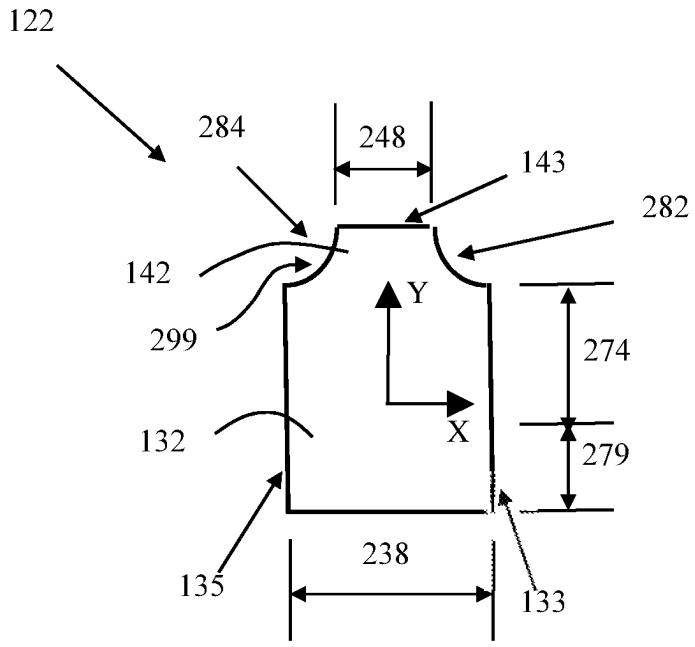

122
284
248
143
282
142
299
Y
274
X
132
279
135
238
133

FIG. 2A

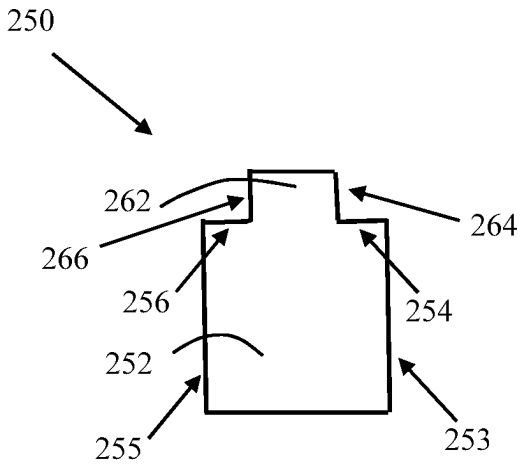

250
262
264
266
256
254
252
255
253

FIG. 2B

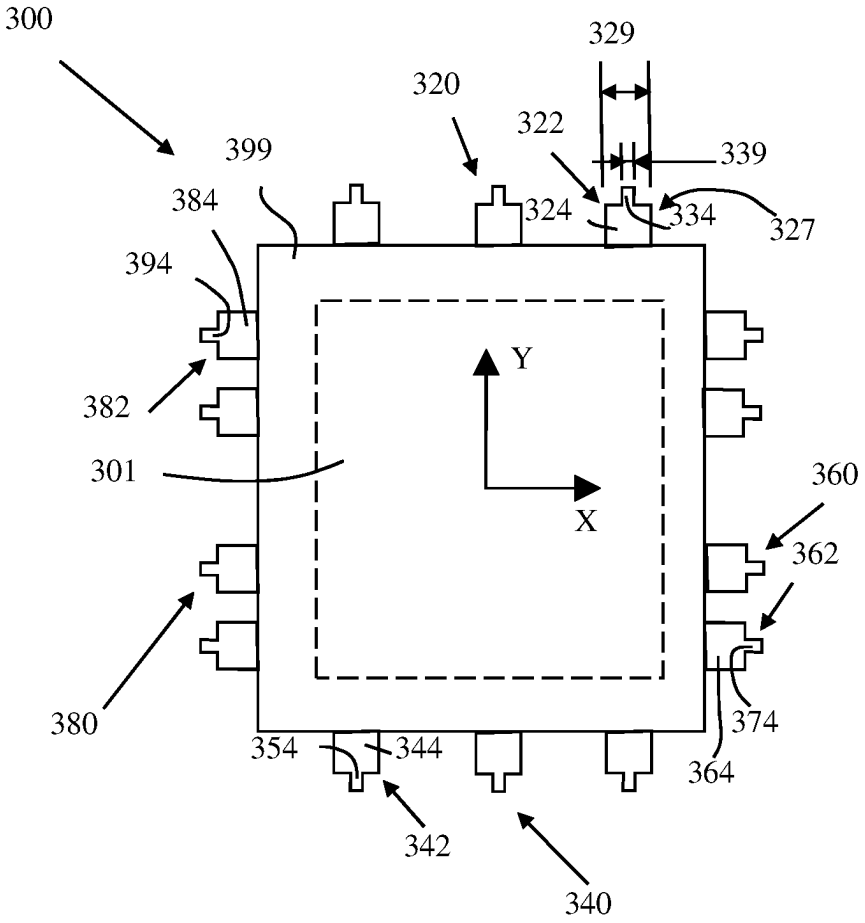

300
329
320
322
399
339
384
324
334
327
394
Y
382
301
360
X
362
380
374
354
344
364
342
340

FIG. 3

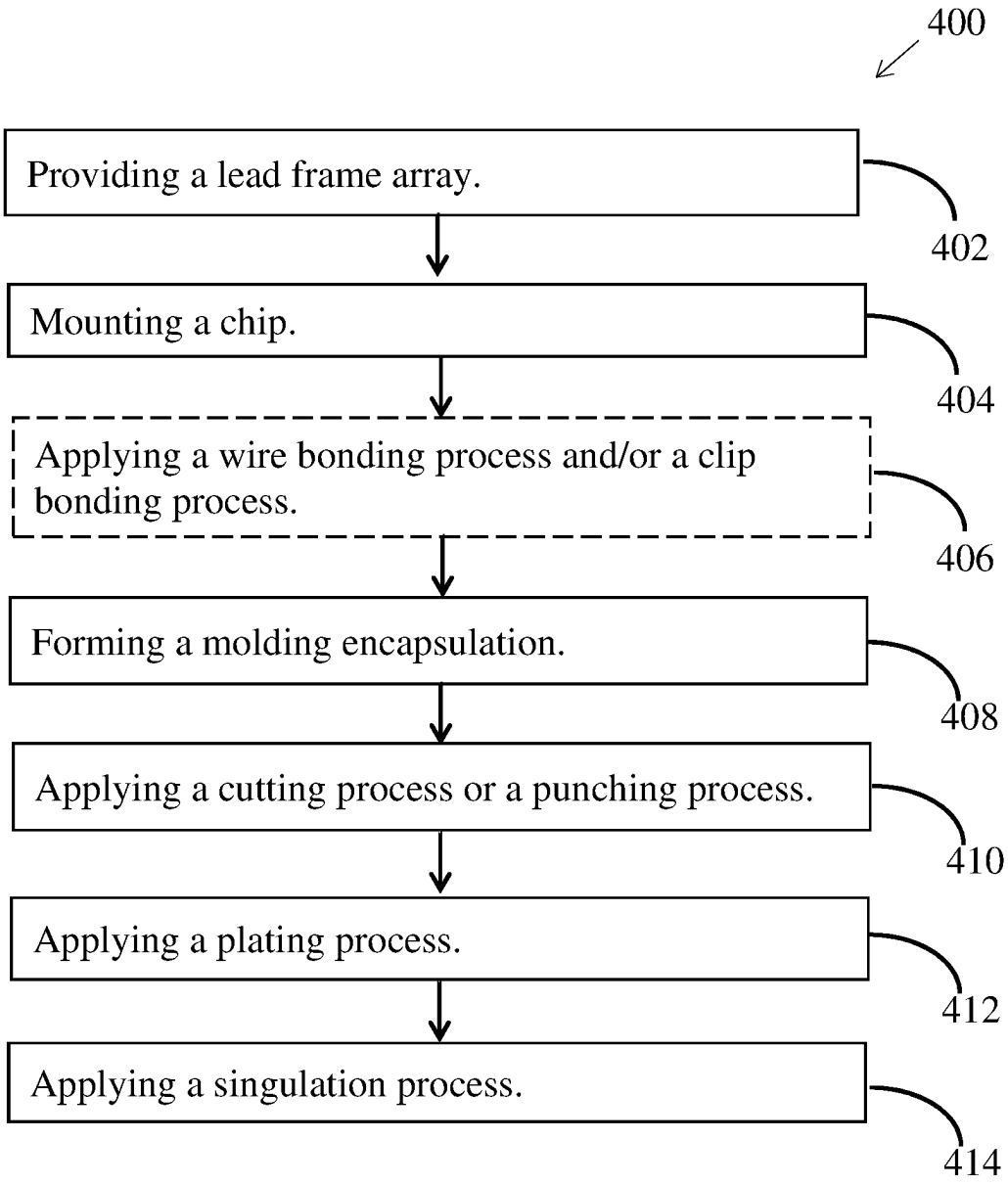

400
Providing a lead frame array.
402
Mounting a chip.
404
Applying a wire bonding process and/or a clip bonding process.
406
Forming a molding encapsulation.
408
Applying a cutting process or a punching process.
410
Applying a plating process.
412
Applying a singulation process.
414

FIG. 4

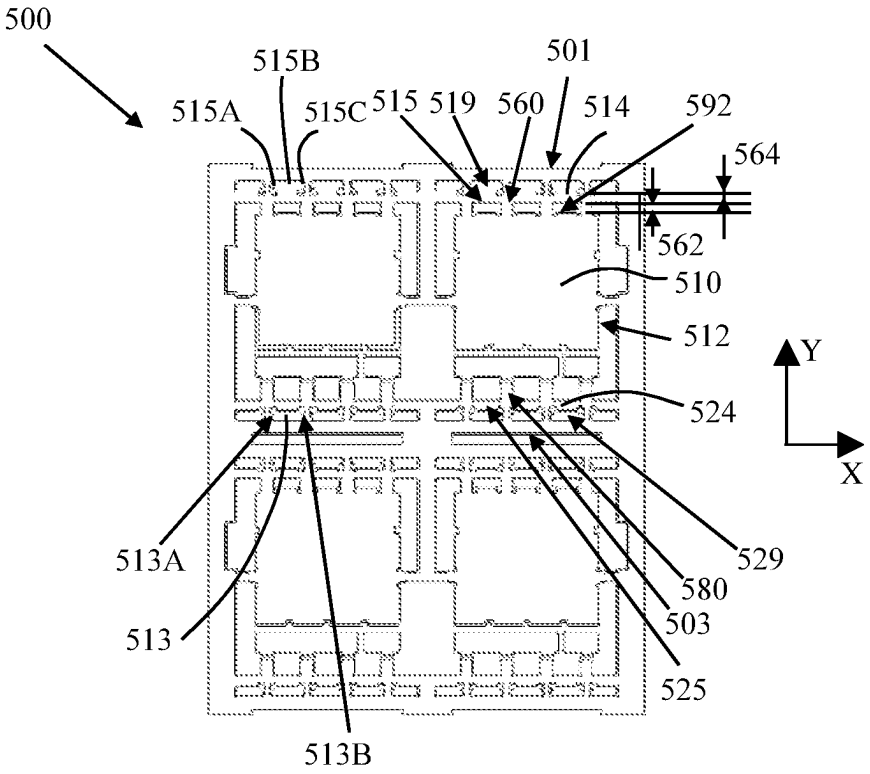

500
515B
501
515A
515C
515
519
560
514
592
564
562
510
512
Y
524
X
513A
529
580
513
503
525
513B

FIG. 5A

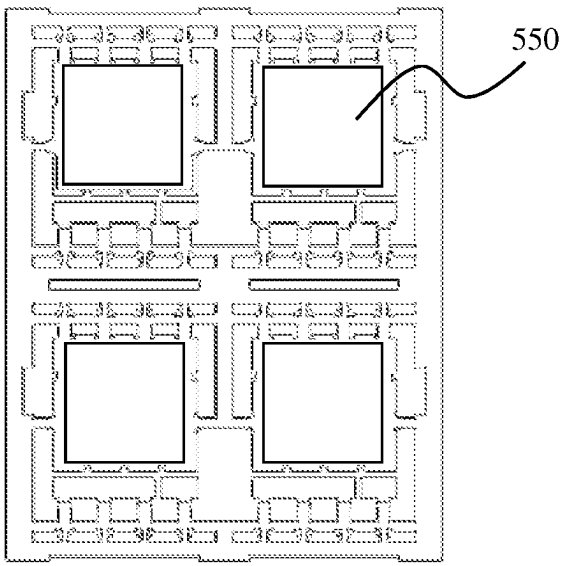

550

FIG. 5B

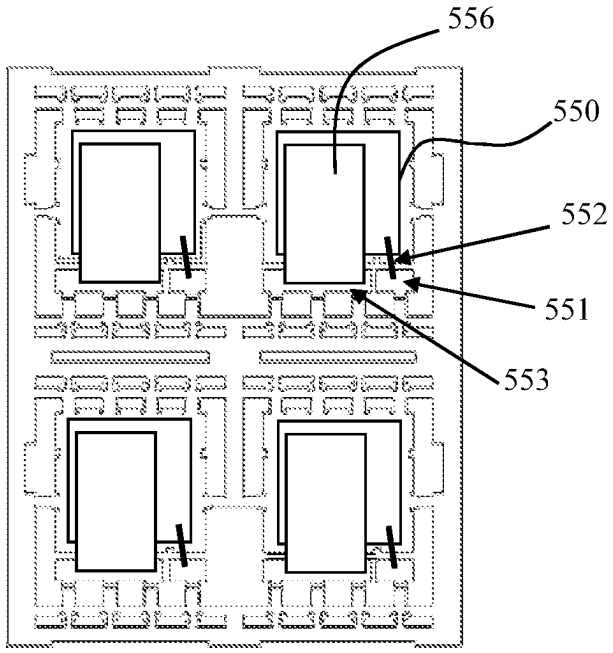


FIG. 5C

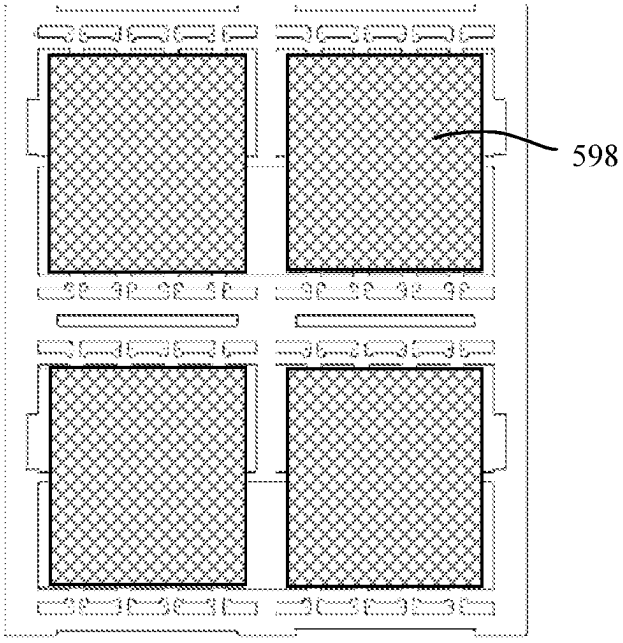


FIG. 5D

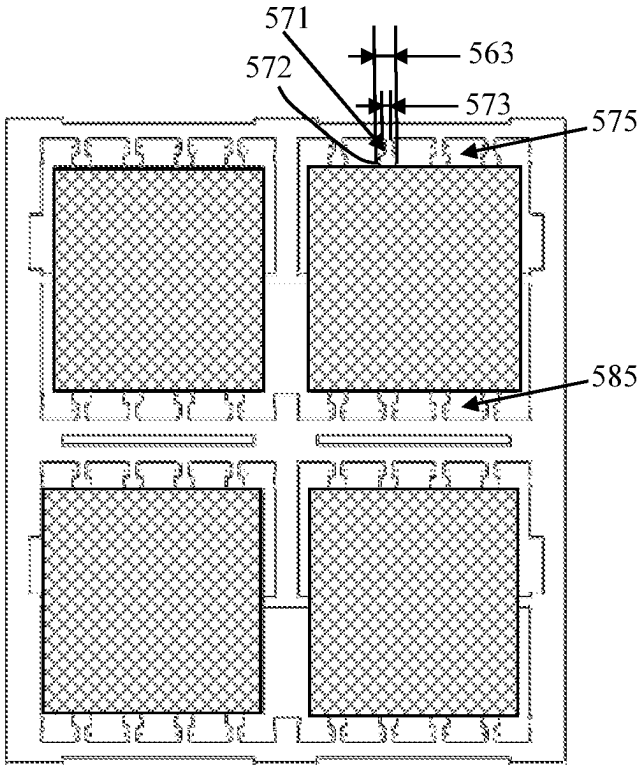


FIG. 5E

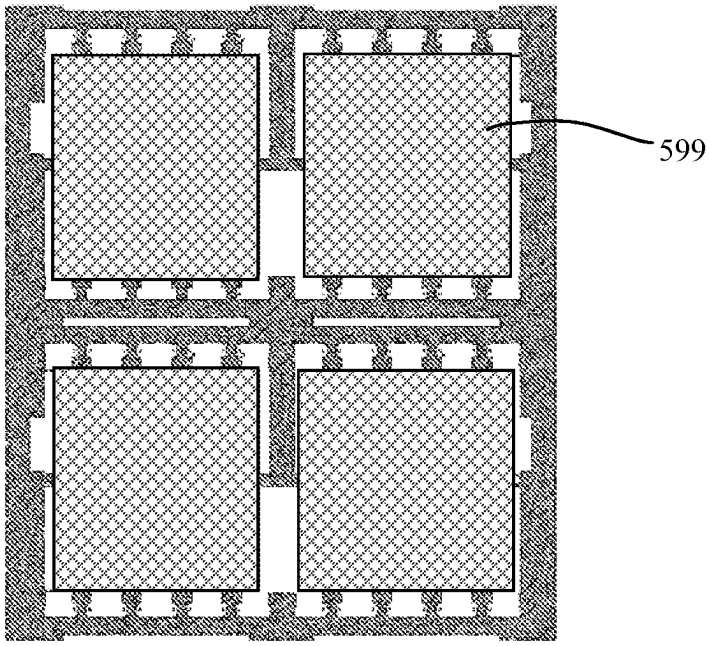


FIG. 5F

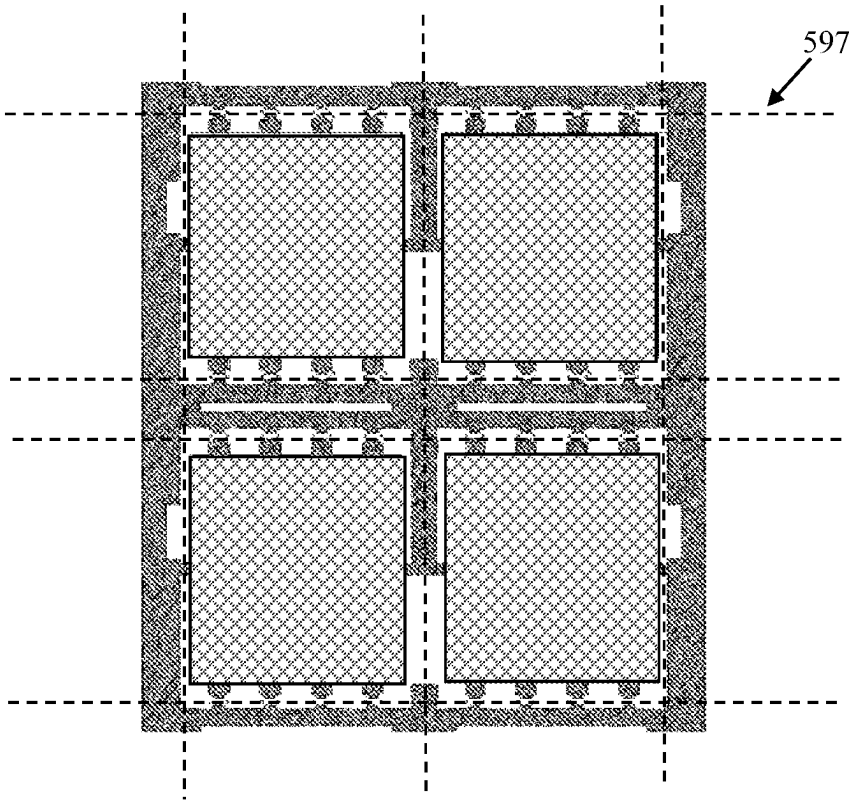


FIG. 5G

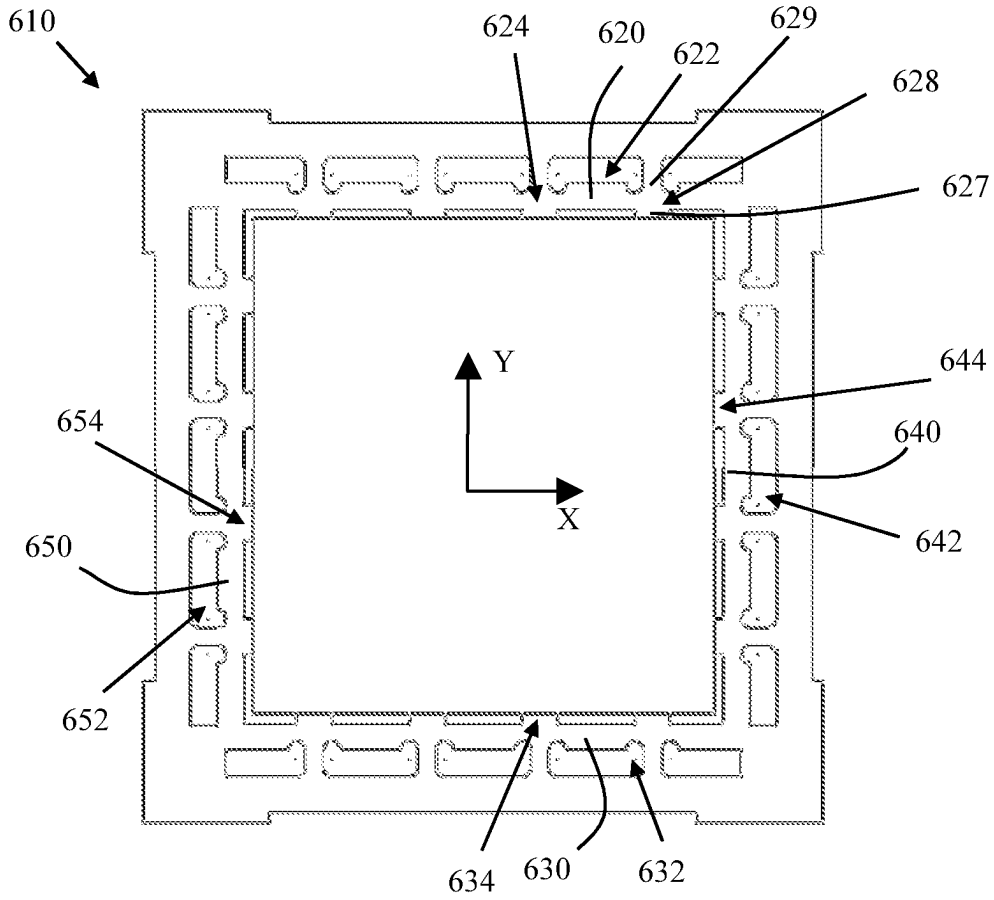

610
624
620
622
629
628
627
Y
X
644
654
640
650
642
652
634
630
632

FIG. 6

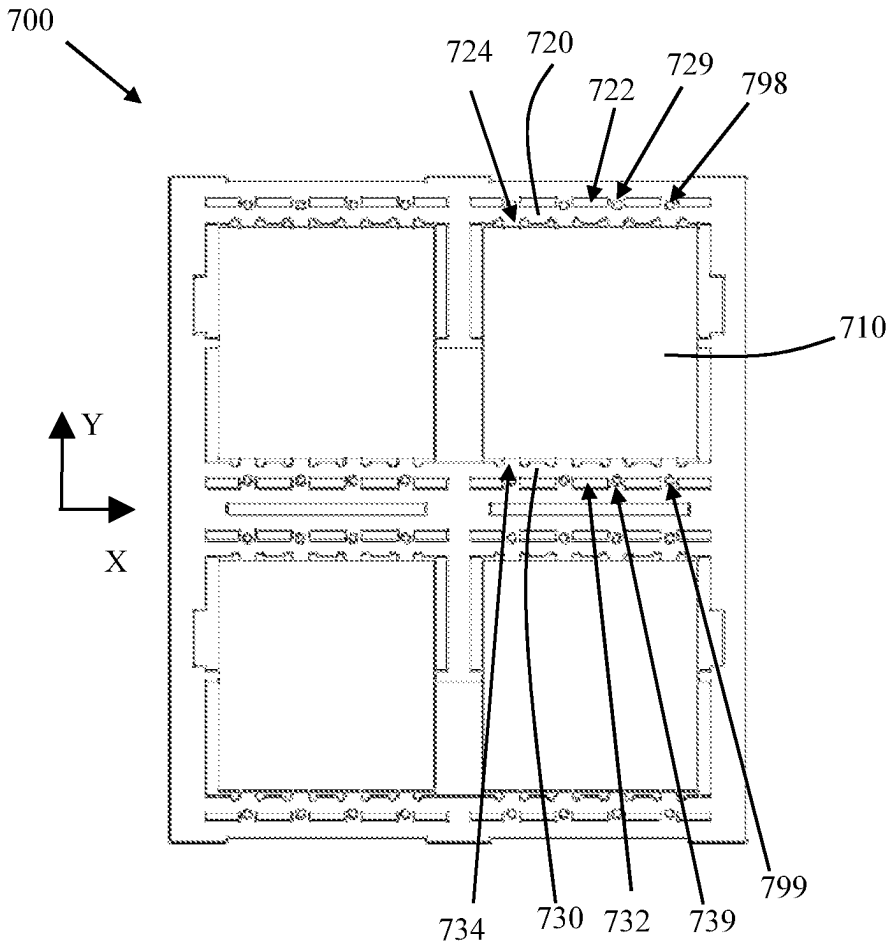


FIG. 7

SEMICONDUCTOR PACKAGE HAVING PARTIALLY PLATED LEAD FLANK AND METHOD OF MAKING THE SAME

FIELD OF THE INVENTION

[0001] This invention relates generally to a semiconductor package having a plurality of leads with partially plated flanks and a method of making the same. More particularly, the present invention relates to a semiconductor package fabricated using a lead frame comprising dam bars and slots.

BACKGROUND OF THE INVENTION

[0002] Conventional Quad-flat no leads (QFN) and Dual-flat no leads (DFN) micro lead packages comprise exposed copper at end surfaces of leads after a singulation process or a punching process. The exposed copper subjects to oxidation over time. The oxidized copper end surfaces degrades a solder connection quality.

[0003] The present disclosure provides a solution by introducing a dam bar and a plurality of slots in a lead frame so as to form a plurality of leads with more than 50% wettable area in an end region and two opposite side surfaces of each of the plurality of leads.

SUMMARY OF THE INVENTION

[0004] The present invention discloses a semiconductor package comprising a lead frame, a chip, and a molding encapsulation. The lead frame comprises one or more die paddles and a plurality of leads. Each of the plurality of leads comprises a base member and a protrusion member. A width of an end surface of the protrusion member of each of the plurality of leads is less than 50% of a width of a corresponding base member so as to improve solderability.

[0005] A method for fabricating semiconductor packages is disclosed. The method comprises the steps of providing a lead frame array, mounting a chip, forming a molding encapsulation, applying a cutting process or a punching process, applying a plating process, and applying a singulation process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. **1** shows a perspective view of a semiconductor package in examples of the present disclosure.

[0007] FIG. **2**A shows a top view of a lead in examples of the present disclosure.

[0008] FIG. **2**B shows a top view of another lead in examples of the present disclosure.

[0009] FIG. **3** is a top view of another semiconductor package in examples of the present disclosure.

[0010] FIG. **4** is a flowchart of a process to develop a semiconductor package in examples of the present disclosure.

[0011] FIGS. **5**A, **5**B, **5**C, **5**D, **5**E, **5**F, and **5**G show the steps of the process to fabricate a semiconductor package in examples of the present disclosure.

[0012] FIG. **6** shows a top view of still another lead frame in examples of the present disclosure.

[0013] FIG. **7** shows a top view of a lead frame array in examples of the present disclosure.

DETAILED DESCRIPTION OF THE INVENTION

[0014] FIG. **1** shows a perspective view of a semiconductor package **100** in examples of the present disclosure. In one example, the semiconductor package **100** is a punched dual flat no-Lead (DFN) package. The semiconductor package **100** comprises a lead frame **510** of FIG. **5**A, a chip **550** of FIG. **5**B, and a molding encapsulation **190**. The lead frame **510** comprises one or more die paddles **512** of FIG. **5**A and a first plurality of leads **120**. The first plurality of leads **120** extend away from the one or more die paddles **512** of FIG. **5**A along a first direction Y. Although four leads **122**, **124**, **126**, and **128** are shown in FIG. **1**, the number of leads included in the first plurality of leads **120** may vary. Each of the first plurality of leads **120** comprises a base member (or base portion) extending outside the molding encapsulation and a protrusion member (or tip portion) extending to the end of each lead. For example, the lead **122** comprises a base member **132** and a protrusion member **142**. In one example, a thickness of the base member **132** equals a thickness of the protrusion member **142**. The protrusion member **142** directly connects to the base member **132**. The base member **132** comprises a first side surface **133** and a second side surface **135**. The protrusion member **142** comprises an end surface **143**. A portion **139** (non-hatched area representing exposed copper after the cutting process) of the first side surface **133** of the base member **132** adjacent the molding encapsulation is not plated. The end surface **143** of the protrusion member **142** is located at the central portion of the end of lead **122** and is not plated. The hatched-line area **134** of the base member **132** and the hatched-line area **144** of the protrusion member **142** are plated with a wettable metal for soldering. The hatched-line area **134** of the base member **132** is directly connected to the hatched-line area **144** of the protrusion member **142**. In one example, the wettable metal for soldering covers the hatched-line area **134** of the base member **132** and the hatched-line area **144** of the protrusion member **142**. In one example, the wettable metal for soldering is tin or Sn.

[0015] The chip **550** of FIG. **5**B is attached to the one or more die paddles **512** of FIG. **5**A of the lead frame **510** of FIG. **5**A. The molding encapsulation **190** encloses the chip **550** of FIG. **5**B.

[0016] FIG. **2**A shows a top view of the lead **122** of FIG. **1** in examples of the present disclosure. A width **248** of the end surface **143** of the protrusion member **142** of the lead **122** is less than 50% of a width **238** of the base member **132** of the lead **122** so as to reduce the non-plated surface at an end region of the lead **122** (to improve solderability). In one example, the width **248** is 0.2 mm and the width **238** is in a range from 0.41 mm to 0.5 mm. More than 50% of the first side surface **133** of the base member **132** of the lead **122** is plated with a wettable metal for soldering [a length **274** of the hatched-line area **134** of FIG. **1** is longer than a length **279** of the portion **139** (non-hatched area) of FIG. **1**] so as to increase the portion of plated side surface of the lead **122** (to improve solderability). Similarly, more than 50% of the second side surface **135** of the base member **132** of the lead **122** is plated with a wettable metal for soldering.

[0017] In examples of the present disclosure, the lead **122** further comprises a first notch **282** and a second notch **284** that form the protrusion member **142** with a shape of reducing width away from the base member **132**. The first notch **282** is positioned between the first side surface **133** of

the base member **132** of the lead **122** and the end surface **143** of the protrusion member **142** of the lead **122** thus forming a first side surface (the hatched-line area **144** of FIG. **1**) of the protrusion member **142**. The second notch **284** is positioned between the second side surface **135** of the base member **132** of the lead **122** and the end surface **143** of the protrusion member **142** of the lead **122** thus forming a second side surface **299** of the protrusion member **142**. The end surface **143** separates the first side surface (the hatched-line area **144** of FIG. **1**) and the second side surface **299** of the protrusion member **142**. The first side surface (the hatched-line area **144** of FIG. **1**) of the protrusion member **142** of the lead **122** and the second side surface **299** of the protrusion member **142** are curve and plated with the wettable metal for soldering.

[0018] FIG. **2**B shows a top view of a lead **250** in examples of the present disclosure. The lead **250** comprises a base member **252** and a protrusion member **262**. In one example, a thickness of the base member **252** equals a thickness of the protrusion member **262**. The protrusion member **262** directly connects to the base member **252**. The protrusion member **262** of the lead **250** comprises a first flat side surface **264** and a second flat side surface **266** opposite the first flat side surface **264**. The base member **252** of the lead **250** comprises a first flat surface **254** and a second flat surface **256**. The first flat surface **254** of the base member **252** is perpendicular to and directly connected to the first side surface **253** of the base member **252**. The second flat surface **256** of the base member **252** is perpendicular to and directly connected to the second side surface **255** of the base member **252**. The first flat side surface **264** of the protrusion member **262**, the second flat side surface **266** of the protrusion member **262**, the first flat surface **254** of the base member **252**, and the second flat surface **256** of the base member **252** are plated with the wettable metal for soldering.

[0019] FIG. **3** is a top view of a semiconductor package **300** in examples of the present disclosure. In one example, the semiconductor package **300** is a punched quad flat no-Lead (QFN) package. The semiconductor package **300** comprises a lead frame **610** of FIG. **6**, a chip **301**, and a molding encapsulation **399**. The lead frame **610** comprises one or more die paddles **512** of FIG. **5**A and a first plurality of leads **320**, a second plurality of leads **340**, a third plurality of leads **360**, and a fourth plurality of leads **380**. The first plurality of leads **320** extend away from the one or more die paddles **512** of FIG. **5**A along a first direction (positive Y direction). The second plurality of leads **340** extend away from the one or more die paddles **512** of FIG. **5**A along a second direction (negative Y direction) opposite the first direction (positive Y direction). The third plurality of leads **360** extend away from the one or more die paddles **512** of FIG. **5**A along a third direction (positive X direction) perpendicular to the first direction (positive Y direction). A fourth plurality of leads **380** extend away from the one or more die paddles **512** of FIG. **5**A along a fourth direction (negative X direction) opposite the third direction (positive X direction).

[0020] Each of the first plurality of leads **320** comprises a base member and a protrusion member. For example, the lead **322** comprises a base member **324** and a protrusion member **334**. Each of the second plurality of leads **340** comprises a base member and a protrusion member. For example, the lead **342** comprises a base member **344** and a protrusion member **354**. Each of the third plurality of leads **360** comprises a base member and a protrusion member. For example, the lead **362** comprises a base member **364** and a protrusion member **374**. Each of the fourth plurality of leads **380** comprises a base member and a protrusion member. For example, the lead **382** comprises a base member **384** and a protrusion member **394**.

[0021] The base member **324** comprises a first side surface **327** and a second side surface. The protrusion member **334** comprises an end surface. A width **339** of the end surface of the protrusion member **334** is less than 50% of the width **329** of the base member **324**. Similar construction for the lead **342**, the lead **362**, and the lead **382**. A width of the end surface of the protrusion member **354** is less than 50% of the width of the base member **344**. A width of the end surface of the protrusion member **374** is less than 50% of the width of the base member **364**. A width of the end surface of the protrusion member **394** is less than 50% of the width of the base member **384**.

[0022] More than 50% of the first side surface **327** of the base member **324** and more than 50% of the second side surface of the base member **324** are plated with a wettable metal for soldering. Similar construction for the lead **342**, the lead **362**, and the lead **382**. More than 50% of the first side surface of the base member **344** and more than 50% of the second side surface of the base member **344** are plated with a wettable metal for soldering. More than 50% of the first side surface of the base member **364** and more than 50% of the second side surface of the base member **364** are plated with a wettable metal for soldering. More than 50% of the first side surface of the base member **384** and more than 50% of the second side surface of the base member **384** are plated with a wettable metal for soldering.

[0023] The end surface of the protrusion member **334**, the end surface of the protrusion member **354**, end surface of the protrusion member **374**, and end surface of the protrusion member **394** are not plated with the metal.

[0024] FIG. **4** is a flowchart of a process **400** to develop a semiconductor package in examples of the present disclosure. The process **400** may start from block **402**. FIGS. **5**A-**5**G show the top view of the corresponding steps.

[0025] In block **402**, referring now to FIG. **5**A, a lead frame array **500** is provided. The lead frame array **500** comprises one or more lead frames including lead frame **510**. Although only four lead frames are shown in FIG. **5**A, the number of lead frames included in the lead frame array **500** may vary. The lead frame **510** comprises one or more die paddles **512**, a first dam bar **514**, a second dam bar **524**, a first plurality of slots **519**, a second plurality of slots **529**, a first plurality of leads **560**, and a second plurality of leads **580**. The first dam bar **514** comprises a first plurality of dam bar connecting sections **515**. The second dam bar **524** comprises a second plurality of dam bar connecting sections **525**. The first plurality of slots **519** are between the first dam bar **514** and a first side **501** of the lead frame **510**. The second plurality of slots **529** are between the second dam bar **524** and a second side **503** of the lead frame **510**.

[0026] The first plurality of leads **560** extend away from the one or more die paddles **512** along a first direction (positive Y-direction). Each of the first plurality of leads **560** is connected to the first dam bar **514**. A second plurality of leads **580** extend away from the one or more die paddles **512** along a second direction (negative Y-direction). Each of the second plurality of leads **580** is connected to the second dam bar **524**.

[0027] In examples of the present disclosure, each of the first plurality of dam bar connecting sections **515** comprises a first end section **515**A, a center section **515**B, and a second end section **515**C. The center section **515**B is between the first end section **515**A and the second end section **515**C. A cross-sectional area of the first end section **515**A is smaller than a cross-sectional area of the center section **515**B. A cross-sectional area of the second end section **515**C is smaller than the cross-sectional area of the center section **515**B.

[0028] In examples of the present disclosure, each of the first plurality of dam bar connecting sections comprises a first arc portion and a second arc portion. For example, damp bar connecting section **513** comprises a first arc portion **513**A and a second arc portion **513**B.

[0029] In examples of the present disclosure, each lead frame of the one or more lead frames further comprises a first plurality of rectangular holes between the first plurality of dam bar connecting sections and the one or more die paddles. For example, the plurality of rectangular holes **592** are between the first plurality of dam bar connecting sections **515** and the one or more die paddles **512**. A lateral dimension of each of the first plurality of rectangular holes is smaller than a lateral dimension of a corresponding dam bar connecting section of the first plurality of dam bar connecting sections. For example, dimension **562** is smaller than dimension **564**. In one example, dimension **562** is 0.1 mm and dimension **564** is in a range from 0.2 to 0.3 mm.

[0030] In examples of the present disclosure, the lead frame array **500** is not a pre-plated frame (PPF) array. Block **402** may be followed by block **404**.

[0031] In block **404**, referring now to FIG. **5**B, a chip **550** is mounted on the one or more die paddles **512**. In one example, the chip **550** is a power semiconductor transistor, such as a metal-oxide-semiconductor field-effect transistor (MOSFET). Block **404** may be followed by block **406** or block **408**.

[0032] In optional block **406** (shown in dashed lines), referring now to FIG. **5**C, a wire bonding process and/or a clip bonding process is applied. One or more wires **552** connect the chip **550** to the gate lead **551** and a clip **556** connect the chip **550** to the source lead **553**. Block **406** may be followed by block **408**.

[0033] In block **408**, referring now to FIG. **5**D, a molding encapsulation **598** is formed. The molding encapsulation **598** encloses the chip **550**. Block **408** may be followed by block **410**.

[0034] In block **410**, referring now to FIG. **5**E, a cutting process or a punching process is applied. The first plurality of dam bar connecting sections **515** of FIG. **5**A are removed so as to form a first plurality of slots **575**. The second plurality of dam bar connecting sections **525** of FIG. **5**A are removed so as to form a second plurality of slots **585**. A width **573** of the end surface of the protrusion member of the lead **571** is less than 50% of a width **563** of the base member **572** of the lead **571** so as to reduce the non-plated surface at an end region of the lead **571** (to improve solderability). Block **410** may be followed by block **412**.

[0035] In block **412**, referring now to FIG. **5**F, a plating process is applied. Portions of the lead frame **510**, not covered by the molding encapsulation **598**, are plated with a wettable metal for soldering **599**. In one example, block **412** is the only plating process in the process **400** (no other plating process is conducted). In one example, the wettable metal for soldering **599** is tin or Sn. Block **412** may be followed by block **414**.

[0036] In block **414**, referring now to FIG. **5**G, a singulation process (along a plurality of cutting lines **597**) is applied so as to form a plurality of semiconductor packages (for example, the semiconductor package **100** of FIG. **1**).

[0037] Process **400** may be also applied to the lead frame **610** of FIG. **6**. The lead frame **610** comprises one or more die paddles, a first dam bar **620**, a second dam bar **630**, a third dam bar **640**, a fourth dam bar **650**, a first plurality of slots **622**, a second plurality of slots **632**, a third plurality of slots **642**, a fourth plurality of slots **652**, a first plurality of leads **624**, a second plurality of leads **634**, a third plurality of leads **644**, and a fourth plurality of leads **654**.

[0038] Still referring to FIG. **6**, the first plurality of leads **624** extend away from the one or more die paddles along a first direction (positive Y-direction). Each of the first plurality of leads **624** is connected to the first dam bar **620**. A second plurality of leads **634** extend away from the one or more die paddles along a second direction (negative Y-direction). Each of the second plurality of leads **634** is connected to the second dam bar **630**. The third plurality of leads **644** extend away from the one or more die paddles along a third direction (positive X-direction). Each of the third plurality of leads **644** is connected to the third dam bar **640**. A fourth plurality of leads **654** extend away from the one or more die paddles along a fourth direction (negative X-direction). Each of the fourth plurality of leads **654** is connected to the fourth dam bar **650**.

[0039] Each of the first plurality of leads **624** comprises a base member and a protrusion member. For example, the lead **628** comprises a base member **627** and a protrusion member **629**. Each of the second plurality of leads **634** comprises a base member and a protrusion member. Each of the third plurality of leads **644** comprises a base member and a protrusion member. Each of the fourth plurality of leads **654** comprises a base member and a protrusion member.

[0040] Process **400** may be also applied to a lead frame array **700** of FIG. **7**. The lead frame array **700** comprises one or more lead frames including a lead frame **710**. The lead frame **710** comprises one or more die paddles, a first dam bar **720**, a second dam bar **730**, a first plurality of slots **722**, a second plurality of slots **732**, a first plurality of holes **729**, a second plurality of holes **739**, a first plurality of leads **724** (extending along positive Y direction), and a second plurality of leads **734** (extending along negative Y direction). Each of the first plurality of holes **729** is between a respective pair of slots of the first plurality of slots **722**. Each of the second plurality of holes **739** is between a respective pair of slots of the second plurality of slots **732**. In one example, each of the first plurality of holes **729** and the second plurality of holes **739** are of a circular shape. In another example, each of the first plurality of holes **729** and the second plurality of holes **739** are of a "+" shape. After going through all the steps of process **400**, an end surface at a tip **798** of a lead of the first plurality of leads **724** will be plated because of the first plurality of holes **729**. An end surface at a tip **799** of a lead of the second plurality of leads **734** will be plated because of the second plurality of holes **739**.

[0041] Those of ordinary skill in the art may recognize that modifications of the embodiments disclosed herein are possible. For example, a number of leads may vary. Other modifications may occur to those of ordinary skill in this art,

and all such modifications are deemed to fall within the purview of the present invention, as defined by the claims.

1. A semiconductor package comprising:

a lead frame comprising:

one or more die paddles; and

a first plurality of leads extending away from the one or more die paddles along a first direction, each of the first plurality of leads comprising:

a base member comprising:

a first side surface; and

a second side surface; and

a protrusion member directly connected to the base member of said first plurality of leads, the protrusion member of said first plurality of leads comprising:

an end surface;

a chip attached to the one or more die paddles of the lead frame; and

a molding encapsulation enclosing the chip;

wherein a width of the end surface of the protrusion member of said each of the first plurality of leads is less than fifty percent of a width of the base member of said each of the first plurality of leads; and

wherein the end surface of the protrusion member of said each of the first plurality of leads is not plated with a wettable metal for soldering.

2. The semiconductor package of claim **1**, wherein more than fifty percent of the first side surface of the base member of said each of the first plurality of leads and more than fifty percent of the second side surface of the base member of said each of the first plurality of leads are plated with the wettable metal for soldering.

3. The semiconductor package of claim **1**, wherein each of the first plurality of leads further comprises:

a first notch positioned between the first side surface of the base member of said each of the first plurality of leads and the end surface of the protrusion member of said each of the first plurality of leads; and

a second notch positioned between the second side surface of the base member of said each of the first plurality of leads and the end surface of the protrusion member of said each of the first plurality of leads; and

wherein a surface of the first notch of said each of the first plurality of leads and a surface of the second notch of said each of the first plurality of leads are plated with the wettable metal for soldering.

4. The semiconductor package of claim **1**,

wherein the protrusion member of said each of the first plurality of leads further comprises:

a first flat side surface; and

a second flat side surface opposite the first flat side surface;

wherein the base member of said each of the first plurality of leads further comprises:

a first flat surface perpendicular to and directly connected to the first side surface of the base member of said each of the first plurality of leads; and

a second flat surface perpendicular to and directly connected to the second side surface of the base member of said each of the first plurality of leads;

wherein the first flat side surface of the protrusion member of said each of the first plurality of leads, the second flat side surface of the protrusion member of said each of the first plurality of leads, the first flat surface of the base member of said each of the first plurality of leads, and the second flat surface of the base member of said each of the first plurality of leads are plated with the wettable metal for soldering.

5. The semiconductor package of claim **1** further comprising a second plurality of leads extending away from the one or more die paddles along a second direction opposite the first direction, each of the second plurality of leads comprising:

a base member comprising:

a first side surface; and

a second side surface; and

a protrusion member directly connected to the base member of said second plurality of leads, the protrusion member of said second plurality of leads comprising:

an end surface;

wherein a width of the end surface of the protrusion member of said each of the second plurality of leads is less than fifty percent of a width of the base member of said each of the second plurality of leads;

wherein more than fifty percent of the first side surface of the base member of said each of the second plurality of leads and more than fifty percent of the second side surface of the base member of said each of the second plurality of leads are plated with the wettable metal for soldering; and

wherein the end surface of the protrusion member of said each of the second plurality of leads is not plated with the wettable metal for soldering.

6. The semiconductor package of claim **5**,

wherein each of the second plurality of leads further comprises:

a first notch positioned between the first side surface of the base member of said each of the second plurality of leads and the end surface of the protrusion member of said each of the second plurality of leads; and

a second notch positioned between the second side surface of the base member of said each of the second plurality of leads and the end surface of the protrusion member of said each of the second plurality of leads; and

wherein a surface of the first notch of said each of the second plurality of leads and a surface of the second notch of said each of the second plurality of leads are plated with the wettable metal for soldering.

7. The semiconductor package of claim **5**,

wherein the protrusion member of said each of the second plurality of leads further comprises:

a first flat side surface; and

a second flat side surface opposite the first flat side surface;

wherein the base member of said each of the second plurality of leads further comprises:

a first flat surface perpendicular to and directly connected to the first side surface of the base member of said each of the second plurality of leads; and

a second flat surface perpendicular to and directly connected to the second side surface of the base member of said each of the second plurality of leads;

wherein the first flat side surface of the protrusion member of said each of the second plurality of leads, the second flat side surface of the protrusion member of said each of the second plurality of leads, the first flat surface of the base member of said each of the second

plurality of leads, and the second flat surface of the base member of said each of the second plurality of leads are plated with the wettable metal for soldering.

8. The semiconductor package of claim **5**,

wherein the lead frame further comprises

a third plurality of leads extending away from the one or more die paddles along a third direction perpendicular to the first direction, each of the third plurality of leads comprising:

a base member comprising:

a first side surface; and

a second side surface; and

a protrusion member directly connected to the base member of said third plurality of leads, the protrusion member of said third plurality of leads comprising:

an end surface; and

a fourth plurality of leads extending away from the one or more die paddles along a fourth direction opposite the third direction, each of the fourth plurality of leads comprising:

a base member comprising:

a first side surface; and

a second side surface; and

a protrusion member directly connected to the base member of said fourth plurality of leads, the protrusion member of said fourth plurality of leads comprising:

an end surface;

wherein a width of the end surface of the protrusion member of said each of the third plurality of leads is less than fifty percent of a width of the base member of said each of the third plurality of leads;

wherein more than fifty percent of the first side surface of the base member of said each of the third plurality of leads and more than fifty percent of the second side surface of the base member of said each of the third plurality of leads are plated with the wettable metal for soldering

wherein the end surface of the protrusion member of said each of the third plurality of leads is not plated with the wettable metal for soldering;

wherein a width of the end surface of the protrusion member of said each of the fourth plurality of leads is less than fifty percent of a width of the base member of said each of the fourth plurality of leads;

wherein more than fifty percent of the first side surface of the base member of said each of the fourth plurality of leads and more than fifty percent of the second side surface of the base member of said each of the fourth plurality of leads are plated with the wettable metal for soldering; and

wherein the end surface of the protrusion member of said each of the fourth plurality of leads is not plated with the wettable metal for soldering.

9. A method for fabricating a semiconductor package, the method comprising the steps of:

providing a lead frame array comprising one or more lead frames, each lead frame of the one or more lead frames comprising

one or more die paddles;

a first dam bar comprising:

a first plurality of dam bar connecting sections;

a second dam bar comprising:

a second plurality of dam bar connecting sections;

a first plurality of slots between the first dam bar and a first side of said each lead frame;

a second plurality of slots between the second dam bar and a second side of said each lead frame, the second side of said each lead frame being opposite the first side of said each lead frame;

a first plurality of leads extending away from the one or more die paddles along a first direction, each of the first plurality of leads being connected to the first dam bar; and

a second plurality of leads extending away from the one or more die paddles along a second direction opposite the first direction, each of the second plurality of leads being connected to the second dam bar;

mounting a chip on the one or more die paddles;

forming a molding encapsulation enclosing the chip;

applying a cutting process or a punching process removing the first plurality of dam bar connecting sections and the second plurality of dam bar connecting sections;

plating tin on portions of the lead frame array not covered by the molding encapsulation; and

applying a singulation process.

10. The method of claim **9**, before the step of forming the molding encapsulation, applying a wire bonding process or a clip bonding process.

11. The method of claim **9**, wherein each of the first plurality of dam bar connecting sections and

the second plurality of dam bar connecting sections comprises

a first end section;

a center section; and

a second end section opposite the first end section;

wherein a cross-sectional area of the first end section is smaller than a cross-sectional area of the center section; and

wherein a cross-sectional area of the second end section is smaller than the cross-sectional area of the center section.

12. The method of claim **9**,

wherein each of the first plurality of leads comprises:

a base member; and

a protrusion member directly connected to the base member of said first plurality of leads;

wherein a width of the protrusion member of said each of the first plurality of leads is less than fifty percent of a width of the base member of said each of the first plurality of leads;

wherein each of the second plurality of leads comprises:

a base member; and

a protrusion member directly connected to the base member of said second plurality of leads; and

wherein a width of the protrusion member of said each of the second plurality of leads is less than fifty percent of a width of the base member of said each of the second plurality of leads.

13. The method of claim **9**, wherein each of the first plurality of dam bar connecting sections comprises:

a first arc portion; and

a second arc portion; and

wherein each of the first plurality of dam bar connecting sections comprises:

a first arc portion; and

a second arc portion.

14. The method of claim **9**, wherein each lead frame of the one or more lead frames further comprises

a first plurality of rectangular holes between the first plurality of dam bar connecting sections and the one or more die paddles;

wherein a lateral dimension of each of the first plurality of rectangular holes is smaller than a lateral dimension of a corresponding dam bar connecting section of the first plurality of dam bar connecting sections.

15. The method of claim **9**, wherein each lead frame of the one or more lead frames further comprises

a third dam bar comprising:

a third plurality of dam bar connecting sections;

a fourth dam bar comprising:

a fourth plurality of dam bar connecting sections;

a third plurality of slots between the third dam bar and a third side of said each lead frame;

a fourth plurality of slots between the fourth dam bar and a fourth side of said each lead frame, the fourth side of said each lead frame being opposite the third side of said each lead frame;

a third plurality of leads extending away from the one or more die paddles along a third direction perpendicular to the first direction, each of the third plurality of leads being connected to the third dam bar; and

a fourth plurality of leads extending away from the one or more die paddles along a fourth direction opposite the third direction, each of the fourth plurality of leads being connected to the fourth dam bar; and

wherein said applying the cutting process or the punching process further removes the third plurality of dam bar connecting sections and the fourth plurality of dam bar connecting sections.

16. The method of claim **15**,

wherein each of the third plurality of leads comprises:

a base member; and

a protrusion member directly connected to the base member of said third plurality of leads;

wherein a width of the protrusion member of said each of the third plurality of leads is less than fifty percent of a width of the base member of said each of the third plurality of leads;

wherein each of the fourth plurality of leads comprises:

a base member; and

a protrusion member directly connected to the base member of said fourth plurality of leads; and

wherein a width of the protrusion member of said each of the fourth plurality of leads is less than fifty percent of a width of the base member of said each of the fourth plurality of leads.

17. The method of claim **9**, wherein each lead frame of the one or more lead frames further comprises

a first plurality of holes, each of the first plurality of holes being between a respective pair of slots of the first plurality of slots; and

a second plurality of holes, each of the second plurality of holes being between a respective pair of slots of the second plurality of slots.

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