

METHOD AND APPARATUS FOR SINGULATING SEMICONDUCTOR PACKAGES ON A LEAD FRAME

Field of the Invention

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The present invention relates in general to singulating semiconductor packages formed on a lead frame and in particular to singulating semiconductor packages formed on a lead frame using a sawing process.

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Background of the Invention

As is known in the manufacture of semiconductor devices, the devices are packaged in a predetermined array on a lead frame, typically by molding. After the devices are packaged, they are singulated or separated from the lead frame. An example of such packages are those referred to as SOT packages.

A conventional method of singulating is to punch out or stamp out the packages from the lead frame. However, with the increasing trend to reduce the size of semiconductor packages, the standards required in the singulation process have also become more stringent. This has made it more difficult for singulation using punching and stamping to meet these standards. Furthermore, punching and stamping are also known to cause package delamination. As such, manufacturers in an effort to increase quality control have migrated from punching and stamping systems to sawing techniques similar to the ones used for singulating semiconductor wafers.

However, with the adoption of sawing as a method for singulation of packaged devices, a new problem arose. That is the difficulty of securing the lead frames during sawing. As with



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semiconductor wafers adhesive tape is used to secure the packages on a lead frame to a cutting table when sawing the packages from the lead frame. The adhesive tape system, however, has several drawbacks. It is costly, as the adhesive tape is not reusable and is
5 thrown away after a single use. Further, during the cutting process, coolants and lubricants are constantly applied onto the cutting table to prevent heat transfer to the packaged devices during sawing and to wash away the sawn off unwanted portions of the lead frame, referred to as debris. However, the adhesive tape can cause the
10 debris to adhere thereto and the accumulated debris can damage the saw blade during the singulation process. Thus, another disadvantage is potentially more down time of the sawing equipment to replace the damaged saw blades.

After the packages are singulated, they remain held by the
15 adhesive tape. Yet another disadvantage is the need for an intermediate step to extract the singulated devices from the adhesive tape and transfer the singulated devices to a tray. A further disadvantage is that the adhesive tape on the cutting table has to be removed and replaced manually which is contrary to the
20 need for a more automated process. In addition, the adhesive tape is not well suited to securing small packages formed on lead frames, especially when the packages are smaller than 5mm by 5mm.

Most processes for singulating packaged semiconductor devices are performed with the packaged device in a 'dead bug' configuration, i.e. where the lead frame is positioned upside down
25 with the molded packaging of the packaged devices facing downwards to facilitate singulation. In this orientation, the adhesive tape adheres to only the molded portion of a packaged device to secure the packaged device to the cutting table.

30 Due to the small surface area of the molded portion of the packaged devices, adhesive tape does not consistently and reliably

secure the packaged devices. As a result, some of the packaged devices are dislodged from the adhesive tape during the sawing process. Indeed, other singulated packages can also become dislodged from the adhesive tape due to the vibration caused by the
5 sawing process. Hence, another disadvantage of the adhesive tape method is its inability to hold the packages securely, particularly packages that are smaller than 5mm by 5mm.

The use of a planar rubber sheet together with vacuum or suction to hold packaged devices on a lead frame when sawing the
10 packaged devices from a lead frame are known. With packaged devices having dimensions greater than 5mm by 5mm, the vacuum and rubber sheet can be used successfully. However, when packaged device dimensions are less than 5mm by 5mm, the vacuum and current rubber sheet method is unable to hold the packaged devices
15 during the sawing process. In an effort to increase the throughput of the singulation process, multiple saw blades mounted on a single chassis commonly referred to as a 'gang saw' are expected to be used. This further compounds the existing problem with holding the packaged devices securely during the sawing process. An example of
20 such a gang saw is model no. DAD695 manufactured by Disco Corporation of Japan.

During singulation, water is directed at the rotating saw blade to keep it cool as the unwanted portions of the lead frame are cut by the saw. In addition, jets of water are also directed at the lead
25 frame on the planar rubber sheet to dislodge the severed unwanted portions of the lead frame from the planar rubber sheet. The flowing water then carries the unwanted portions of the lead frame to a disposal location. A disadvantage of this method, however, is that there is a tendency for the unwanted portions of the leadframe to
30 adhere to the planar rubber sheet. It has been discovered that burrs on the unwanted portions, as a result on the sawing process, claw

into the planar rubber sheet, and neither the water jets nor the flow of water is able to efficiently dislodge the unwanted portions of the lead frame from the planar rubber sheet.

5 The presence of the unwanted portions of the leadframe on the rubber sheet prevents the next leadframe from sitting properly on the planar rubber sheet. As a result, singulated packages that are singulated from a lead frame in the presence of the unwanted portions, either are not held securely on the planar rubber sheet or can't be subsequently picked-off the planar rubber sheet after
10 singulation.

Brief Summary of the Invention

15 The present invention seeks to provide a method and apparatus for singulating semiconductor packages on a leadframe, which overcomes or at least reduces the abovementioned problems of the prior art.

Accordingly, in one aspect, the present invention provides a sawing jig for holding semiconductor packaged devices formed on a
20 lead frame, said semiconductor packaged devices arranged in a predetermined pattern on the lead frame, said sawing jig comprising:

a first plate having an array of openings in a first surface, the array of openings extending to a second surface, opposite the first surface, wherein the first surface for disposing the lead frame
25 thereon, wherein the array of openings are arranged in a corresponding pattern as the semiconductor packaged devices on the leadframe, wherein each of the openings is contoured to receive one of the semiconductor packaged devices, and wherein each of the openings has a predetermined depth;

30 a resilient layer having a first surface for abutting the second surface of the first plate, the first surface with a corresponding

pattern of tubular protrusions extending therefrom, and the resilient layer having a second surface, opposite the first surface, with a pattern of openings corresponding to the pattern of tubular protrusions, wherein each of the tubular protrusions for extending
5 into one of the openings in the first plate, wherein the each of the tubular protrusions has a predetermined length, and wherein the predetermined length is less than the predetermined depth; and

a second plate having a corresponding pattern of openings, each of the openings extending from a first surface to a second
10 surface, opposite the first surface, the first surface of the second plate for abutting the second surface of the resilient layer, and the corresponding pattern of openings for pneumatically coupling a vacuum applied on the second surface of the second plate to the semiconductor packaged devices via the tubular protrusions and the
15 openings in the first plate.

In another aspect the present invention provides a system for singulating semiconductor packaged devices on a lead frame, said semiconductor packaged devices being formed in a predetermined pattern on the leadframe, said system comprising:

20 a platform having a pattern of inlets on a first surface and a pattern of outlets on a second surface coupled to the inlets on the first surface, said pattern of outlets for coupling to a vacuum source;

a sawing jig for disposing on the platform, the saw jig
25 comprising:

a first plate having an array of openings in a first surface, the array of openings extending to a second surface, opposite the first surface, wherein the first surface for disposing the lead frame thereon, wherein the array of openings are arranged in a
30 corresponding pattern as the semiconductor packaged devices on the leadframe, wherein each of the openings is contoured to receive

one of the semiconductor packaged devices, and wherein each of the openings has a predetermined depth;

5 a resilient layer having a first surface for abutting the second surface of the first plate, the first surface with a corresponding pattern of tubular protrusions extending therefrom, and the resilient layer having a second surface, opposite the first surface, with a pattern of openings corresponding to the pattern of tubular protrusions, wherein each of the tubular protrusions for extending into one of the openings in the first plate, wherein the
10 each of the tubular protrusions has a predetermined length, and wherein the predetermined length is less than the predetermined depth; and

a second plate having a corresponding pattern of openings, each of the openings extending from a first surface to a second surface, opposite the first surface, the first surface of the
15 second plate for abutting the second surface of the resilient layer, and the corresponding pattern of openings for pneumatically coupling to the pattern of inlets on the first surface of the platform; and

20 cutting means for singulating said packaged devices from said lead frame.

In yet another aspect the present invention provides a method for singulating semiconductor packaged devices formed on a lead frame, said semiconductor packaged devices being arranged in a
25 predetermined pattern on the lead frame, said method comprising the steps of:

a) providing a sawing jig comprising:

a first plate having an array of openings in a first surface, the array of openings extending to a second surface, opposite the first surface, wherein the first surface for disposing the
30 lead frame thereon, wherein the array of openings are arranged in a

corresponding pattern as the semiconductor packaged devices on the leadframe, wherein each of the openings is contoured to receive one of the semiconductor packaged devices, and wherein each of the openings has a predetermined depth;

5 a resilient layer having a first surface for abutting the second surface of the first plate, the first surface with a corresponding pattern of tubular protrusions extending therefrom, and the resilient layer having a second surface, opposite the first surface, with a pattern of openings corresponding to the pattern of
10 tubular protrusions, wherein each of the tubular protrusions for extending into one of the openings in the first plate, wherein the each of the tubular protrusions has a predetermined length, and wherein the predetermined length is less than the predetermined depth; and

15 a second plate having a corresponding pattern of openings, each of the openings extending from a first surface to a second surface, opposite the first surface, the first surface of the second plate for abutting the second surface of the resilient layer, and the corresponding pattern of openings for pneumatically coupling a
20 vacuum applied on the second surface of the second plate to the semiconductor packaged devices via the tubular protrusions and the openings in the first plate;

b) aligning the leadframe with the first plate of the sawing jig, such that the packaged devices on the leadframe are aligned with
25 the openings on the first plate;

c) disposing the leadframe on the first plate with the packaged devices on the leadframe sitting in the openings abutting the ends of the tubular protrusions;

- d) applying a vacuum to the second surface of the second plate, thereby applying the vacuum to the packaged devices on the leadframe;
- e) cutting the leadframe to singulate the semiconductor
- 5 packaged devices from the leadframe; and
- f) turning off the vacuum.

Brief Description of the Drawings

10 FIG. 1 shows a plan view of a singulating system incorporating a sawing jig in accordance with the present invention;

FIG. 2 shows an exploded view of the sawing jig in accordance with the present invention that is used in the singulating system in FIG. 1;

15 FIG. 3A shows a cross-sectional view of a portion of the sawing jig in FIG. 3 with packaged devices on a lead frame aligned on the first plate;

FIG. 3B shows the cross-sectional view of the portion of the sawing jig in FIG. 3 when the packaged devices on the lead frame
20 are secured by a vacuum;

FIG. 3C shows the cross-sectional view of the portion of the sawing jig in FIG. 3 after the packaged devices have been singulated from the lead frame;

FIG. 3D shows the cross-sectional view of the portion of the
25 sawing jig in FIG. 3 when the vacuum securing the packaged devices is turned off; and

FIG. 4 shows a flowchart detailing the operation of the singulating system in FIG. 1.

Detailed Description of the Drawings

The present invention provides a sawing jig, which comprises a first metal plate having a pattern of openings for receiving the packaged devices on the leadframe, a second metal plate having a
5 corresponding pattern of vacuum openings, and a rubber sheet held between the first and second metal plates, and having a corresponding pattern of openings for communicating the vacuum applied to the second plate to the openings in the first plate. The
10 rubber sheet being shaped to deform to provide a pneumatic seal around each of the packaged devices held by a vacuum in the openings of the first metal plate.

The first metal plate further having recesses through which the saw blade travels to cut through the lead frame and singulates
15 the packaged devices from unwanted portions of the leadframe. As the unwanted portions of the leadframe abut the first metal plate, the water jets and the flow of water advantageously washes the unwanted portions of the leadframe away from the first metal plate, leaving the singulated packaged devices held in the openings of the
20 first metal plate. When the vacuum is turned off, the deformed portions of the rubber sheet returns to its original shape, advantageously allowing the singulated packaged devices to easily removed from the openings in the first metal plate.

The sawing pad is made of Naprene rubber with a shore
25 hardness of 60°. This material imbues the pad with characteristics that serves to provide better holding force in holding the packaged devices with a vacuum.

Referring to FIG. 1, a sawing and sorting system 100 comprises an on-loading bay 120, a singulation unit 122, a flipper
30 unit 124, a washing and drying module 126 and an offloading module 128. The singulation unit 122 further comprises a sawing jig 150, in

accordance with the present invention, shown in FIG. 3 and sawing equipment (not shown) for singulating packaged devices on a leadframe (shown in FIG. 3). The offloading module 128 further comprises of an X-Y table 130 and a vision device 134 for inspection
5 of the singulated packaged devices. The offloading module 128 includes a turret 132 carrying multiple pick up heads (not shown) for transferring the singulated packaged devices from carrier units to reject boat 136 and outgoing boat 140. An example of such a turret would be one supplied by Tactical Automation Pte Ltd. of Singapore.

10 When the boats are full, they are transferred respectively to a reject tray 138 and outgoing trays 142. The system 100 further comprises several subsystems not shown in the drawing, including robotic arms and grips, pick-up heads, carrier units and conveying rails for transporting the lead frame and the packaged devices.

15 With reference to FIG. 2 a leadframe 205 has a number of packaged semiconductor packages 210 formed thereon with unwanted portions 215, and includes alignment openings 220. The sawing jig 230 comprises a first plate 240, a rubber layer 250 and a second plate 260. The first plate 240 has an upper contoured surface
20 241, which includes openings 242 that are suitably sized to receive the packaged devices 210 on the lead frame 205. In addition, the upper contoured surface 241 includes recesses 244 that run along both sides of the openings 242. The recesses 244 provide the relief within which a saw blade (not shown) travels when the leadframe
25 205 is singulated. Alignment pins 290 are mounted to and extend perpendicularly from, the first plate 240. When placing the leadframe 205 on the first plate 240, the alignment openings 220 of the leadframe 205 are aligned and engage with the alignment pins 290. The leadframe 205 is then slid along the alignment pins 290
30 until the lead frame 205 abuts the upper contoured surface 241 of the first plate 240, with the packaged devices 210 partially within

the openings 242. In an alternative embodiment, alignment pins are located on the pick up head the picks up the leadframe 205, and the upper contoured surface 241 of the first plate 240 has corresponding openings into which the alignment pins on the pick up head fits. In
5 this way the lead frame 205 is alignment with the upper contoured surface 241.

The rubber layer 250 has a contoured upper surface 251 with extending tubular portions 252 that fit into the openings 242 of the upper plate 240. The height of the tubular portions 252 is less than
10 the depth of the openings 240, so the ends 253 of the tubular portions 252 sit within the openings 242. When the lead frame 205 is placed on the first plate 240, the packaged devices 210 in the openings 242 rests on the ends 253 of the tubular portions 252.

The second plate 260 has openings 262 that align with the
15 tubular portions 252. A vacuum applied to the lower surface of the second plate is conveyed through the openings 262, and the tubular portions 252, to the packaged devices 210.

Referring now to FIG. 3A when the leadframe 205 is placed on the contoured upper surface 241 of the first plate 240, the packaged
20 devices 210 abut the ends 253 of the tubular portions 252. With reference to FIG. 3B, when a vacuum is applied below 305 the second plate 260, the vacuum pulls the packaged devices 210 down into the openings 242. The ends 253 of the tubular portions 252 is squeezed and deforms between the packaged devices 210 and the
25 wall of the openings 242, maintaining a good pneumatic seal around the packaged devices 210. This advantageously allows the packaged devices 210 to be securely held by the vacuum.

With reference now to FIG. 3C, while the packaged devices 210 are held securely by the vacuum, the leadframe 205 is cut 310 with a
30 saw (not shown) that travels within the recesses 244. The packaged devices 210 are now individually held by the vacuum. As the

unwanted portion 215 of the lead frame 205 abuts the contoured upper surface 241 of the first plate 240 during the sawing process, the unwanted portion 215 can be easily removed from the contoured upper surface 241 by water jets.

5 Then with reference to FIG. 3D, the vacuum is turned off, allowing the ends 253 of the tubular portions 252 be restored to their un-deformed shape. This pushes the singulated packaged devices 210 out from the openings 242, and the singulated packaged devices 210 now rests on the ends 253 of the tubular portions 252.

10 With reference now to FIG. 4, a process 400 of singulating and sorting the packaged devices 210 on the lead frame 205 starts 405 with placing 410 the lead frame 205 into the on-loading unit 120. The lead frame 205 is first conveyed 415 to the singulation unit 122. The lead frame 205 is then automatically aligned 420 with, and
15 lowered onto, the sawing jig 230. As mentioned earlier, alignment is done with alignment pins 290 engaging the alignment openings 220 on the leadframe 205. When the lead frame 205 is mounted on the first plate 240 of the sawing jig 230, the packaged devices 210 fit in the openings 242, as shown in FIG. 3A, and as described in detail
20 earlier. A vacuum chuck (not shown) below the second plate 260 of the sawing jig 230 applies a vacuum, and the packaged devices 210 on the lead frame 205 is pulled against the first plate 240 by the suction of the vacuum, as shown in FIG. 3B, and described in detail earlier. The sawing and singulation process 430 can now begin, and
25 a rotating saw blade (not shown) is guided through the recesses 244 on the first plate 240 to singulate the packaged devices 210. This is shown in FIG. 3C, as described earlier.

 When all the packaged devices 210 have been singulated and the unwanted portions of the leadframe 205 has been removed, the
30 vacuum chuck is disengaged 435. To urge the packaged devices 210 out of the openings 242, compressed air may be forced through from

the lower side of the second plate 260, through the openings 262, through the tubular portions 252, and against the packaged devices 210, to free the packaged devices 210. This is sometimes referred to as purging.

5 The singulated packaged devices 210 are then individually picked up by a vacuum device and conveyed together to the flipper unit 124, which flips 440 the packaged devices 210, such that the packaged devices 210 are in a 'live bug' configuration, meaning that the molded packaging of the packaged devices 210 are facing up or
10 the packaged devices 210 are right side up. The flipped packaged devices 210 are now held in a carrier that has a recess for each of the packaged devices 210. The packaged devices 210, then undergo washing and drying 445 at the wash and dry module 126 to remove any debris or waste material. A wash liquid such as water is sprayed
15 onto the carrier for washing. The carrier is then dried with hot air. Next, the carrier is moved to the offloading module 128 for quality inspection and sorting 250 of the singulated packaged devices 210. An X-Y table 130 orientates the packaged devices 210 on the carrier for inspection by a vision device 134. Packaged devices 210 that fail
20 quality control standards are rejected and picked up by pick up heads (not shown) mounted on the turret 132, and transferred to a reject boat 124, which when full is then transferred to a reject tray 138. The good devices are finally placed into an outgoing boat 140, which when full are transferred to an outgoing tray 142. In this way
25 the singulated packaged devices 210 are checked and sorted, after which the process 400 ends 455.

The present invention as described singulates packaged devices on a leadframe, and allows the unwanted portions of the leadframe to be disposed with water jets and the flow of water.

30 This is accomplished by a sawing jig that comprises an first plate with openings for receiving the packaged devices, a layer of

rubber with raised tubular portion that sit in the openings of the first plate, and a second plate that abuts and hold the layer of rubber in place. Vacuum is conveyed through openings in the second plate, through the tubular portions of the rubber layer, to pull in
5 and hold the packaged devices in the openings in the first plate. As the rubber deforms around the packaged devices when the vacuum is applied, the deformed rubber forms a good pneumatic seal around the packed devices. Thus, resulting in the packaged devices being securely held during the sawing process.

10 A sawing blade is guided through recesses in the first plate to singulate the packaged devices from the leadframe. As the leadframe abuts the contoured upper surface of the first plate during the sawing process, there resultant unwanted portions of the leadframe on the first plate can be readily disposed with water jets and the
15 flow of water.

The present invention therefore provides a method and apparatus for singulating semiconductor packages on a leadframe, which overcomes or at least reduces the abovementioned problems of the prior art.

20 It will be appreciated that although only a particular embodiment of the invention has been described in detail, various modifications and improvements can be made by a person skilled in the art without departing from the scope of the present invention.

CLAIMS

1. A sawing jig for holding semiconductor packaged devices formed on a lead frame, said semiconductor packaged devices
5 arranged in a predetermined pattern on the lead frame, said sawing jig comprising:

a first plate having an array of openings in a first surface, the array of openings extending to a second surface, opposite the first surface, wherein the first surface for disposing the lead frame
10 thereon, wherein the array of openings are arranged in a corresponding pattern as the semiconductor packaged devices on the leadframe, wherein each of the openings is contoured to receive one of the semiconductor packaged devices, and wherein each of the openings has a predetermined depth;

15 a resilient layer having a first surface for abutting the second surface of the first plate, the first surface with a corresponding pattern of tubular protrusions extending therefrom, and the resilient layer having a second surface, opposite the first surface, with a pattern of openings corresponding to the pattern of tubular
20 protrusions, wherein each of the tubular protrusions for extending into one of the openings in the first plate, wherein the each of the tubular protrusions has a predetermined length, and wherein the predetermined length is less than the predetermined depth; and

a second plate having a corresponding pattern of openings,
25 each of the openings extending from a first surface to a second surface, opposite the first surface, the first surface of the second plate for abutting the second surface of the resilient layer, and the corresponding pattern of openings for pneumatically coupling a vacuum applied on the second surface of the second plate to the
30 semiconductor packaged devices via the tubular protrusions and the openings in the first plate.

2. A sawing jig in accordance with claim 1, wherein the first plate includes a pattern of recesses, wherein the recesses provide a clearance within which a saw blade travels to singulate the packaged devices from the leadframe.

3. A sawing jig in accordance with claim 1, wherein the difference between the predetermined length of the tubular protrusions and the predetermined depth of the openings in the first plate determine the position of the packaged devices in the openings of the first plate when the leadframe is placed on the sawing jig before the vacuum is applied.

4. A sawing jig in accordance with claim 1, wherein the ends of the tubular protrusions are deformable between the packaged devices and the inside walls of the openings in the first plate.

5. A sawing jig in accordance with claim 1, wherein each of the openings in the first plate is dimensioned with sufficient clearance to allow any one of the packaged devices travel within the each of the openings in the first plate.

6. A sawing jig in accordance with claim 1 wherein the first plate is made of rigid material.

7. A sawing jig in accordance with claim 1 wherein the second plate is made of rigid material.

8. A sawing jig in accordance with claim 1 wherein the resilient layer is made of rubber.

9. A sawing jig in accordance with claim 8 wherein the resilient layer is made of Naprene rubber.
10. A sawing jig in accordance with claim 9 wherein the resilient
5 layer is made of Naprene rubber with a shore hardness of sixty degrees.
11. A sawing jig in accordance with claim 1 wherein first plate
10 comprises alignment features thereon for aligning with alignment features on the leadframe.
12. A sawing jig in accordance with claim 1 wherein the first plate,
the resilient layer and the second plate are held together with a
fastening means.
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13. A sawing jig in accordance with claim 1 wherein the fastening
means comprises at least one bolt extending between the first and
second plate and through the resilient layer.
- 20 14. A sawing jig in accordance with claim 1 wherein the first and
second plates are fabricated from a single piece of rigid material and
the resilient layer introduced between the first and second plates.
- 25 15. A system for singulating semiconductor packaged devices on a
lead frame, said semiconductor packaged devices being formed in a
predetermined pattern on the leadframe, said system comprising:
a platform having a pattern of inlets on a first surface
and a pattern of outlets on a second surface coupled to the inlets
on the first surface, said pattern of outlets for coupling to a vacuum
30 source;

a sawing jig for disposing on the platform, the saw jig comprising:

5 a first plate having an array of openings in a first surface, the array of openings extending to a second surface, opposite the first surface, wherein the first surface for disposing the lead frame thereon, wherein the array of openings are arranged in a corresponding pattern as the semiconductor packaged devices on the leadframe, wherein each of the openings is contoured to receive one of the semiconductor packaged devices, and wherein each of the
10 openings has a predetermined depth;

a resilient layer having a first surface for abutting the second surface of the first plate, the first surface with a corresponding pattern of tubular protrusions extending therefrom, and the resilient layer having a second surface, opposite the first
15 surface, with a pattern of openings corresponding to the pattern of tubular protrusions, wherein each of the tubular protrusions for extending into one of the openings in the first plate, wherein the each of the tubular protrusions has a predetermined length, and wherein the predetermined length is less than the predetermined
20 depth; and

a second plate having a corresponding pattern of openings, each of the openings extending from a first surface to a second surface, opposite the first surface, the first surface of the second plate for abutting the second surface of the resilient layer,
25 and the corresponding pattern of openings for pneumatically coupling to the pattern of inlets on the first surface of the platform; and

cutting means for singulating said packaged devices from said lead frame.

16. A system for singulating semiconductor packaged devices in accordance with claim 15 further comprising a securing means for securing the sawing jig to the platform.

5 17. A system for singulating semiconductor packaged devices in accordance with claim 15, wherein the first plate of the sawing jig includes a pattern of recesses, wherein the recesses provide a clearance within which the cutting means travels to singulate the packaged devices from the leadframe.

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18. A system for singulating semiconductor packaged devices in accordance with claim 15 further comprising checking means for identifying at least one of the singulated semiconductor packaged devices to be rejected and identifying the respective locations of the
15 singulated semiconductor packaged devices to be rejected on the lead frame.

19. A system for singulating semiconductor packaged devices in accordance with claim 18 further comprising a plurality of pick and
20 place heads coupled to the checking means, the plurality of pick and place heads for separating rejected semiconductor packaged devices according to the respective locations of the singulated semiconductor packaged devices to be rejected on the lead frame.

25 20. A system for singulating semiconductor packaged devices in accordance with claim 15, wherein the ends of the tubular protrusions of the resilient layer of the sawing jig are deformable between the packaged devices and the inside walls of the openings in the first plate.

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21. A system for singulating semiconductor packaged devices in accordance with claim 15 wherein the first plate is made of rigid material.

5 22. A system for singulating semiconductor packaged devices in accordance with claim 15 wherein the second plate is made of rigid material.

23. A system for singulating semiconductor packaged devices in
10 accordance with claim 15 wherein the resilient layer is made of rubber.

24. A system for singulating semiconductor packaged devices in accordance with claim 15 wherein the first plate, the resilient layer
15 and the second plate are held together with a fastening means.

25. A method for singulating semiconductor packaged devices formed on a lead frame, said semiconductor packaged devices being arranged in a predetermined pattern on the lead frame, said method
20 comprising the steps of:

a) providing a sawing jig comprising:

25 a first plate having an array of openings in a first surface, the array of openings extending to a second surface, opposite the first surface, wherein the first surface for disposing the lead frame thereon, wherein the array of openings are arranged in a corresponding pattern as the semiconductor packaged devices on the leadframe, wherein each of the openings is contoured to receive one of the semiconductor packaged devices, and wherein each of the
30 openings has a predetermined depth;

a resilient layer having a first surface for abutting the
second surface of the first plate, the first surface with a

corresponding pattern of tubular protrusions extending therefrom,
and the resilient layer having a second surface, opposite the first
surface, with a pattern of openings corresponding to the pattern of
tubular protrusions, wherein each of the tubular protrusions for
5 extending into one of the openings in the first plate, wherein the
each of the tubular protrusions has a predetermined length, and
wherein the predetermined length is less than the predetermined
depth; and

a second plate having a corresponding pattern of openings,
10 each of the openings extending from a first surface to a second
surface, opposite the first surface, the first surface of the second
plate for abutting the second surface of the resilient layer, and the
corresponding pattern of openings for pneumatically coupling a
vacuum applied on the second surface of the second plate to the
15 semiconductor packaged devices via the tubular protrusions and the
openings in the first plate;

- b) aligning the leadframe with the first plate of the sawing jig,
such that the packaged devices on the leadframe are aligned with
the openings on the first plate;
- 20 c) disposing the leadframe on the first plate with the packaged
devices on the leadframe sitting in the openings abutting the ends
of the tubular protrusions;
- d) applying a vacuum to the second surface of the second plate,
thereby applying the vacuum to the packaged devices on the
25 leadframe;
- e) cutting the leadframe to singulate the semiconductor
packaged devices from the leadframe; and
- f) turning off the vacuum.

26. A method for singulating semiconductor packaged devices in accordance with claim 25 wherein step (e) comprises the step of sawing the leadframe with at least one rotary saw blade.

5 27. A method for singulating semiconductor packaged devices in accordance with claim 26 further comprising the step of directing liquid at the saw blade when sawing the leadframe.

10 28. A method for singulating semiconductor packaged devices in accordance with claim 26 further comprising the step of directing liquid at the leadframe when sawing the leadframe to displace unwanted portions of the leadframe.

15 29. A method for singulating semiconductor packaged devices in accordance with claim 28 further comprising the step of maintaining a flow of the liquid across the leadframe when sawing the leadframe to transport the unwanted portions of the leadframe to a disposal location.