

# EP&T



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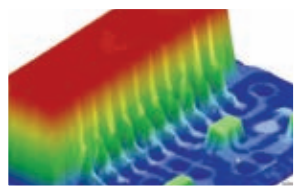
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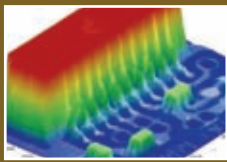
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## Contract Manufacturing & Production Equipment

# Avoid overlooking depaneling step in the pcb manufacturing process

By Shane Stafford, market development representative, LPKF Laser & Electronics North America

**Depaneling** is a step easily overlooked in the printed circuit board (pcb) manufacturing process. A great board design, flawless circuit etching and perfectly placed components mean nothing if individual pcbs cannot be separated from a panel without damaging components, solder joints, or the board itself. Conventional depaneling methods such as die punching, pizza cutting and routing impose levels of mechanical stress that exacerbate these issues, leaving a substantial amount of profit in the depaneling line's waste bin.

The percentage of usable boards removed from a panel is known as production yield. The higher the yield the better, and far too often contract manufacturers are depaneling boards at alarmingly low yield percentages. With pcb designs getting smaller and shifting away from traditional square shaping, finding the depaneling method that meets the efficiency levels OEMs desire is becoming more important than ever.

### Comparing methods

As pcbs get smaller, components are being forced closer and closer to the edge of boards and many manufacturers are seeing sensitive components such as ceramic capacitors coming back from the production house damaged.

To compensate for this, conventional depaneling methods leave manufacturers with two options: either fit fewer parts to each panel in order to leave a mechanical stress 'cushion' around each board (the recommended cushion for pizza cutting can be as high as 5mm), or leave panels full but experience painfully low yield

percentages. For decision makers, this is a lose-lose situation - but it doesn't have to be.

To eliminate the mechanical stress that is the source of damaged components, under-populated panels and low yield percentages, manufacturers can turn to UV laser cutting. An accurate, stress-free pcb processing solution, UV laser cutting is especially suited for depaneling because it completely eliminates the mechanical stress caused by conventional depaneling methods. This frees board designers to place components right up to the very edge of boards.

Additionally, with a 20 $\mu$ m beam width

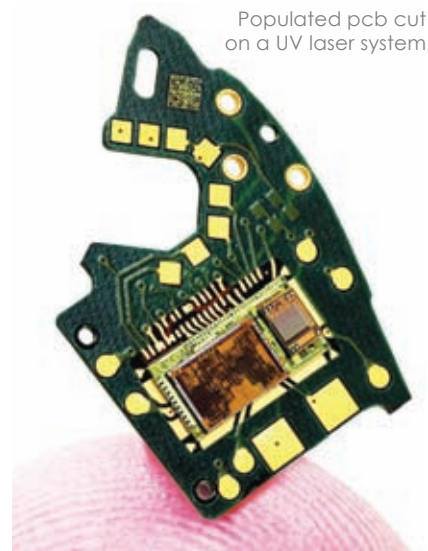
that is 250 times smaller than the ceiling 5mm cushion for pizza cutting, UV laser depaneling allows pcb panels to be filled to potential. Clean, precise cuts can occur without spacing boards out and wasting panel real estate. Unlike the lose-lose scenario described above, the alternative proposed by UV laser depaneling is an all-around win.

### Why UV?

By replacing physical tools with a virtual one (the laser beam), no contact is made with the panel and the effects of mechanical stress are wiped away - but that's not the only way UV laser depaneling reduces the amount of stress imposed on pcbs.

When it comes to depaneling, there are two types of stress that can be imposed on the board. As we've discussed, one of these is mechanical stress. The other is thermal stress, which results in adverse effects caused by excess heat. The most common of effect of thermal stress is burning.

There are two primary methods of laser cutting when it comes to printed circuit board depaneling. CO2 lasers, which operate at high energy levels, produce a very hot cut which increases the chances of effects such as burning.



Populated pcb cut on a UV laser system

On the other hand, UV laser systems operate at much lower wattage than CO2 systems and produce what is known as cold ablation. So while you may say to yourself, "It's great that lasers eliminate mechanical stress, but what if my boards get toasted," you can rest easy knowing that the effects of thermal stress are greatly limited by the thermally cool nature of UV laser depaneling.

Figures 1 and 2 show a comparison of UV laser depaneling and CO2 laser cutting. As you can see, the effects of thermal stress are limited with the UV laser. Both lasers in this application feature a beam size of 20 $\mu$ m. However, due to its

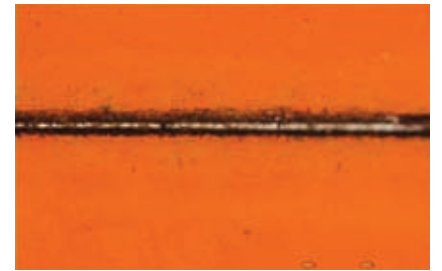


FIG. 1: 125 $\mu$ m Kapton polyimide cut with CO2 laser system



FIG. 2: Same material cut with a UV laser system

hot, high-powered nature, the CO2 laser produces considerable more burning and deformation to the flexible Kapton material. Accommodating for these effects requires a 100 $\mu$ m cut cushion, making an effective cut width of 120 $\mu$ m. The effects of thermal stress are limited by the cold ablation of the UV laser, however, and require only a 10 $\mu$ m cushion. This results in an effective cut width of 30 $\mu$ m.

In this case, working with a UV laser is going to not only eliminate mechanical stress but also greatly reduce any effects of thermal stress, leaving behind a clean, precise cut.

### Other benefits

The application shown in Figures 1 and 2 brings up another benefit of depaneling with UV lasers: the ability to work with a wide variety of materials. From standard FR4 to flexible or soft materials, UV depaneling is suited to process any board material. Polyimide, PET, PTFE, Rogers materials and fired and unfired ceramics present no problems for the stress-free ablation of UV laser depaneling.

Additionally, as boards get smaller and move away from square shaping to fit the demand for miniaturization, UV lasers are especially adept at cutting boards with round and/or arbitrary contours.

UV laser cutting is ideal for applications that are 62 mils thick or less, but can cut thicker applications if the board is scored prior to ablation.

### Conclusion

As manufacturers seek to increase the amount of usable boards returned from the production house, there is one depaneling method that satisfies the demand for higher yield percentages while also providing the flexibility needed in today's ever-changing circuit board design landscape. That method is UV laser cutting.

With UV laser cutting, effects such as cracked components, board fractures, and broken solder joints are eliminated. In addition, the same stress-free nature that helps increase yield percentages also makes UV laser cutting especially suited for working with delicate and flexible materials. Coupled with the precise nature of its 20 $\mu$ m beam, UV laser depaneling is ideal for cutting miniature, arbitrary designs.

For more information on depaneling methods for pcbs from LPKF Laser & Electronics North America, go to <http://ept.hotims.com/46003-64>



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