Technical Disclosure Commons

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RF Shield Pick Bridge

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Background

RF shields are used to contain the radio waves. The shields prevent waves from escaping the source and prevents the source from interacting or disrupting other frequencies in the proximity. A pick structure is generally designed within the perimeter in the static or fixed part of the RF shield with consideration of electronic components on the PCB, thermal heat spreader, mechanical fasteners, etc.

The purpose of the pick structure is to provide and support a pick region during SMT operation. The RF shield fences are picked from the center of gravity of the fence, using the frame of the fence pick structure with the help of a suction nozzle assembly in the SMT operation. This automated operation also places the shield fence on the circuit board for assembly. After placement and the reflow solder process, the pick structure is manually or automatically removed to allow for subsequent operations such as automatic optical inspection of electronic components, edge bonding, rework of components, and assembly with a hard removable shield lid or a foil lid through mechanical and chemical adhesion to become one whole RF shield.

Benefits and problem solutions:

- The pick structure can be removed in a single piece- enhance productivity and yield.
- The bridge can be removed in a single pull action- enhance productivity and yield.
- The pick structure can adapt to different fence overhang design scenarios, available surface area of the fence overhang and other constraints.
- The pick structure substantially reduces or eliminates deformation on the interface of the bridge- increase product quality, yield, productivity, and reduces cost.
- The required small form factor creates more usable spaces for electronic components and other components.
- The pick structure can adapt to different sizes- short, small shield to tall, larger shield.
- The pick structure provides more controlled, consistent, and repeatable force required to operate.
- The intuitive design significantly eliminates user's confusion and minimizes user's error.
- The special bridge removal tool eliminates user's error and reduces waste, cost and rework.
- The pick structure significantly cuts down the time required to remove the pick structure (50% to 75%).
- There is no restriction on the placement orientation- it can be placed in any orientation.

- The efficient and minimal usage of surface area on the fence overhang allows better surface bonding and retention in use cases with the thin foil lid.
- The pick structure allows and adapts tall electronic components which extend beyond the overall fence height.
- The pick structure has more robust bridge feature which is less susceptible to breaking and damage from shipping and transportation.

Solution A

In this solution (*refer Figure 3*), the bridge is attached to the fence overhang such that the bridge is carved out from the fence overhang. Some of the surface material from the fence overhang is removed to make the required room for the bridge. The bridge can also be attached to the fence overhang by partially extending the material from the overhang and the bridge can be attached if the space is limited. A V-shaped scored feature (*refer Figure 4*) is formed on both sides of the bridge where the fence overhang meets with the bridge landing. The manufactured score cut or score v-cut, can vary in design based on the supplier's capabilities to control depth, angle, width, and length. This feature must breakaway within specific guidelines supplied by the designer according to material type and thickness. The V-shaped feature acts as a weakest link and is prone to fracture. A pull tab is formed to the fence overhang at the tangency of the bridge landing. On the other side of the bridge, the material is considerably necked down transitioning from the pick structure to allow for a torsional moment. The torsional moment and V-Cut are aligned on a single axis working as a unit but, must remain perpendicular to one another. This feature could be referred to as a hinge for simplicity. This hinge unit does not need to be perpendicular to the fence lid and can be oriented at many angles (*refer Figure 7*). An optional stiffening rib feature is formed closer to the bridge on the fence overhang to provide added rigidity which also minimize deflection during the bridge removal process. When the pull tab is pulled at an angle or arc motion along the axis, it generates torsional stresses on the hinge and, shear stresses on the V-shaped feature simultaneously. When the internal stresses exceed the material maximum strength, the bridge will break away from the fence overhang. The hinge has higher resistance and tolerance to torsional stresses during the bridge removal process and it will remain attached to the pick structure.

Figure 3: Solution A

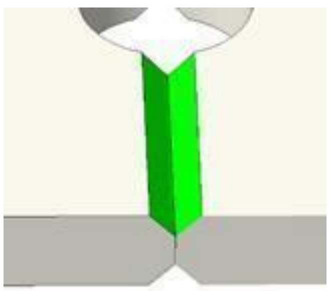

Figure 4: V-shaped scored feature

Solution B

In this solution (*refer Figure 5*), the whole bridge landing is stepped down and sits at a lower plane as compared to the fence overhang. The bridge is slightly necked down to divert stresses towards the bridge, and a V-shaped scored feature (*refer Figure 4*) is formed in parallel to the fence overhang on both sides of the bridge. The manufactured score cut or score v-cut, can vary in design based on the supplier’s capabilities to control depth, angle, width and length. This feature must breakaway within specific guidelines supplied by the designer according to material type and thickness. The design intent of the stepped feature are (1) to provide added rigidity which reduces the deflection considerably lower compared to the existing solution and (2) in addition, the stepped feature provides a considerable margin for the deformation to take place at the bridge in some thin walled cases which does not impact the product quality, production yield, and assembly with the shield lid. A pull tab is formed in parallel to the fence overhang and in alignment with the bridge. On the opposing side of the bridge, the material is considerably necked down coming from the higher pick structure plane to allow for torsional moment. This feature could be referred to as a hinge for simplicity. The bridge can be attached to the fence overhang in various orientations as depicted in *Figure 7*. When the pull tab is pulled at an angle, the bridge experiences shear force at the start of the V-shaped scored feature and the hinge experiences torsional stresses simultaneously. When the internal stresses exceed the material maximum strength, it will initiate cracks at the start of the V-shaped scored feature. The crack will propagate down towards the other end of the bridge with an increased applied force. Consequently, the bridge will shear off and detach from the fence overhang. The hinge has higher resistance and tolerance to internal stresses compared to that of the bridge and it will withstand the subjected torsional moment and allows the bridge to break away without breaking away from the pick structure.

Figure 5: Solution B

Both solution A and B could be used independently on its own or interchangeably in different combination to accommodate different use cases depicted below as examples (*refer Figure 6*).

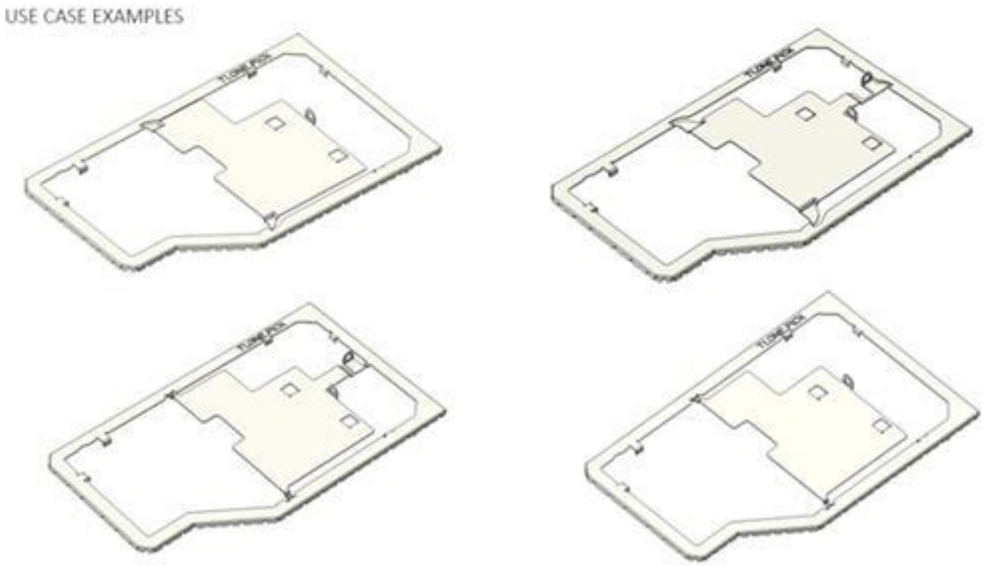

Figure 6: Examples of potential usage combination

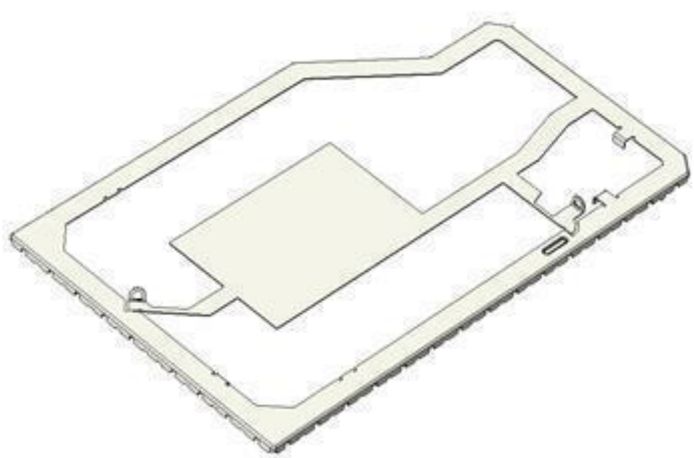

Figure 7: Depiction of the bridge placement in multiple orientations