

## Using Heat-Mask in the Thermoforming Machine for Component Positioning in Thermoformed Electronics

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**Abstract :** For several years, 3D-shaped electronics have been rising, with many uses in home appliances, automotive, and manufacturing. One of the biggest challenges in the fabrication of 3D shape electronics, which are made by thermoforming, is repeatable and accurate component positioning, and typically there is no control over the final position of the component. This paper aims to address this issue and present a reliable approach for guiding the electronic components in the desired place during thermoforming. We have proposed a heat-control mask in the thermoforming machine to control the heating of the polymer, not allowing specific parts to be formable, which can assure the conductive traces' mechanical stability during thermoforming of the substrate. We have verified our approach's accuracy by applying our method on a real industrial semi-sphere mold for positioning 7 LEDs and one touch sensor. We measured the LEDs' position after thermoforming to prove the process's repeatability. The experiment results demonstrate that the proposed method is capable of positioning electronic components in thermoformed 3D electronics with high precision.

**Keywords :** 3D-shaped electronics, electronic components, thermoforming, component positioning

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