Part Size and Part Rotation in Carrier Tape

A Guide for Understanding the Relationship

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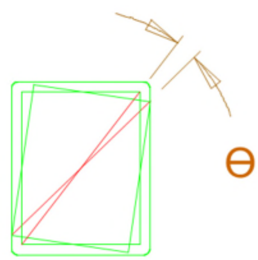
Understanding the rotational limits of part control related to part to pocket clearance.

As parts gets smaller and smaller, it becomes much more difficult to minimize the part rotation due to the higher percentage the tolerance makes up of both the part size and pocket size. Even a part with ±0.02mm tolerance and a pocket with ±0.03mm tolerance will have a minimum part to maximum pocket clearance of 0.10mm.

Part fit for rectangular devices is based on the corners hitting the side wall, and can be computed using the diagonal length of the part relative to the length and width of the pocket. See Figure 2

- Θ is the difference between Θ1 and Θ2.



- Summary:

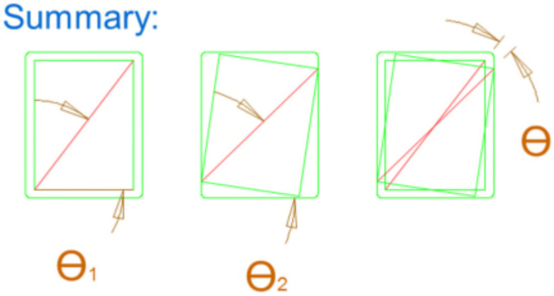


Figure 1

Using this information, a series of graphs were made for various device sizes with a maximum clearance of 0.10mm. The first target was to maintain a maximum rotation of 20°. Examples of long narrow devices to square devices were created to plot out an area that could not meet the 20° maximum rotation. Any combination of width and length that lies inside the yellow area will have a rotation greater than 20°. See Figure 2.

The Dimension 1 and Dimension 2 on the graph could be any of the 3 basic dimensions of the part-- width, length or depth, corresponding to the Ao, Bo or Ko. The relationship would be the same in all instances.

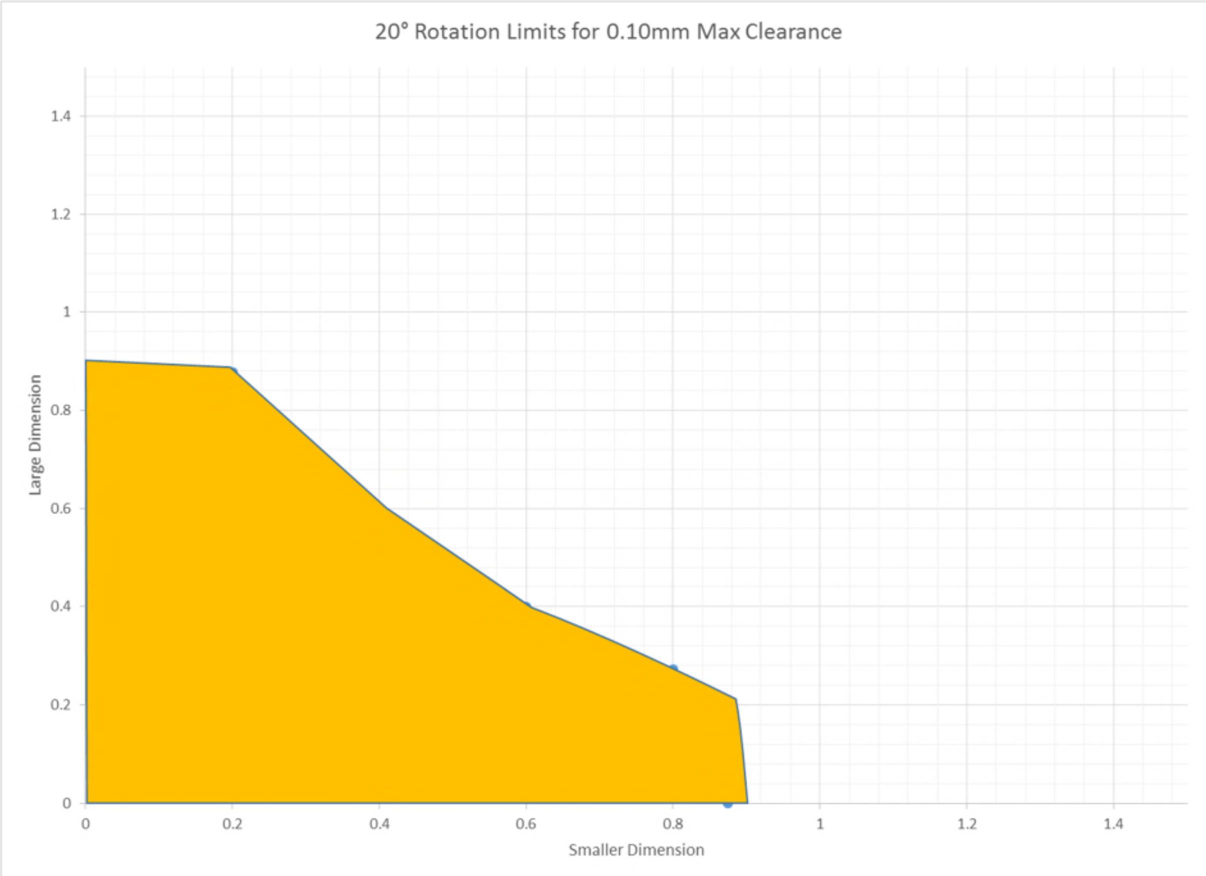


Figure 2

For a square device, the graph shows that the smallest square device that can maintain a 20° rotation is about 0.5x0.5mm. A long narrow device such as 0.2x0.9mm would also be on the edge, while any device with all sides being 0.9mm or larger would fall outside the yellow area and rotate less than 20° in a pocket with 0.10mm maximum clearance

This was also done for a 10° rotation limit and a 5° rotation limit and all plotted on the same graph. The graphs show that the tighter the rotation limit, the larger the parts have to be in order to be constrained. Note that the purple for the 5° limit goes all the way to the origin of the graph, as does the red for the 10° limit. See Figure 3

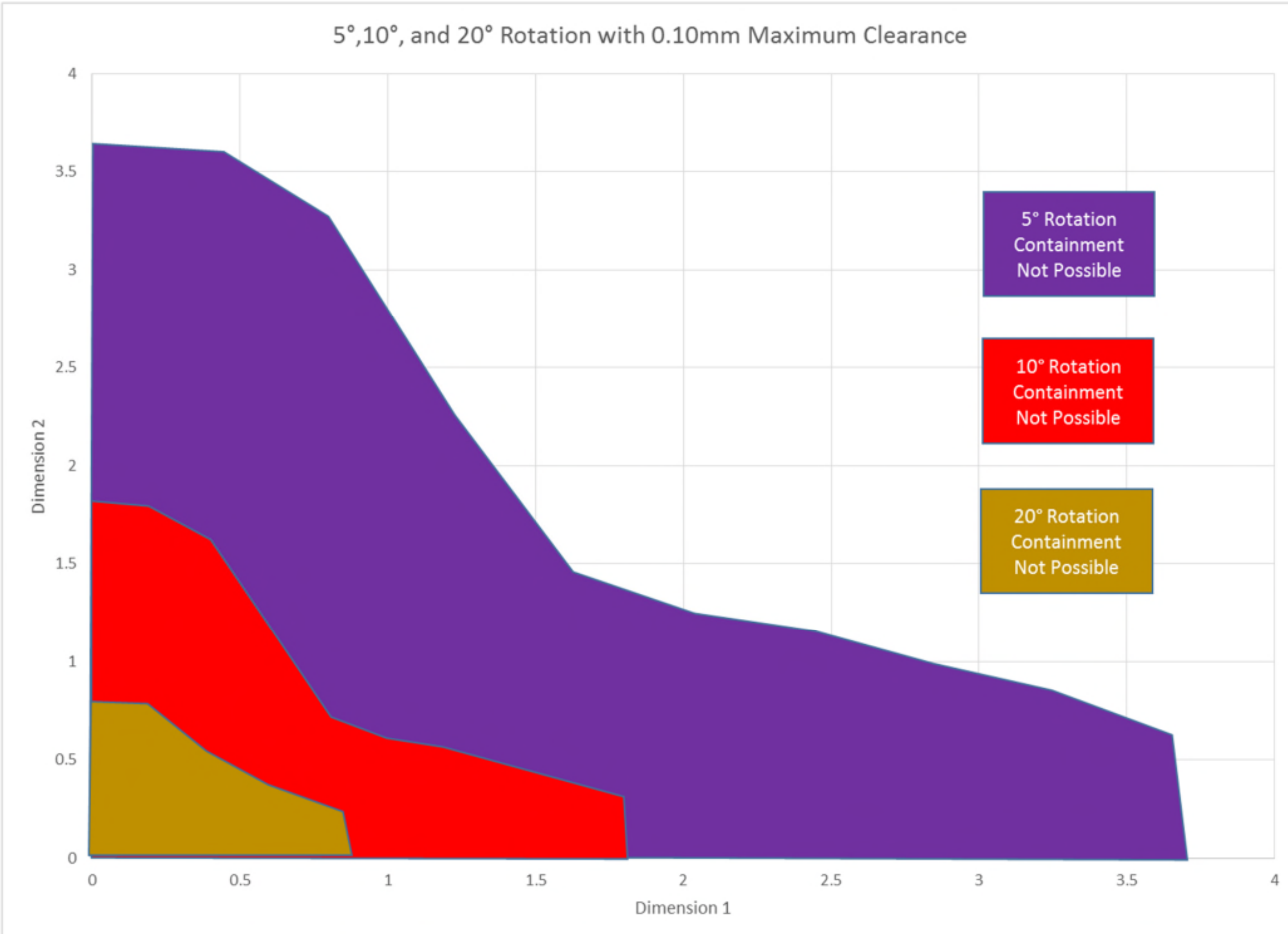


Figure 3

For smaller maximum clearances, the graphs above would pull in towards the origin on the graph. Conversely, larger clearances would push the graphs farther away from the origin.

In summary, the desire to limit rotation to a very tight level gets more difficult as the parts get smaller due to the basic geometry of the pocket and large clearances relative to the device size.