NanoFab's

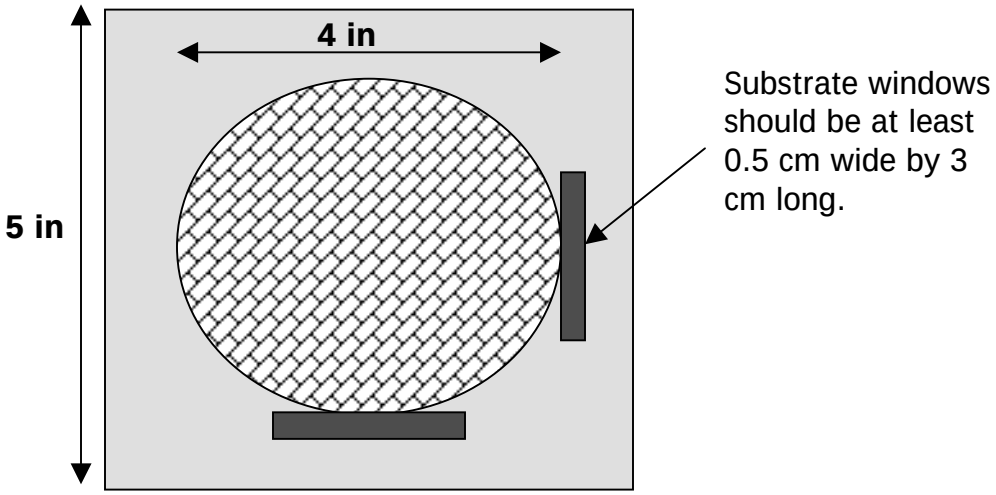
Pattern Generator Considerations

General

- All masks are 5" soda lime glass squares with a thickness of 0.09".
- Masks are coated with chrome and 530 nm of AZ 1518 photoresist.
- One color (i.e. gds number) should be used for one layer. Make sure that the color has a GDS number in L-EDIT by right-clicking the color's box, choosing setup. Under the General tab a number will be in the GDS II box.
- If there is no GDS number or the GDS number is 0, your design will not work.
- Do not flatten your design or it will not work.
- Do not have any self intersecting polygons.
- Each patterned layer in your device requires its own mask, therefore if there are 3 layers, than 3 masks must be printed.
- Using the hierarchical design ability, cell and instance commands help making additions, alterations, and deletions to the design much easier.
- L-EDIT manuals are available on bookracks outside of gowning.

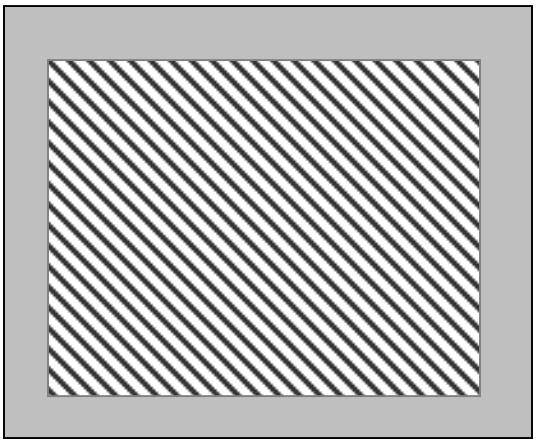
Substrate Alignment Windows

Make sure that you leave windows in your mask so that you can align your mask with respect to your substrate. These windows should just touch the edge of your substrate, so that you are sure that you design is centered and properly aligned. For example, if your substrate is a 4 inch silicon substrate:

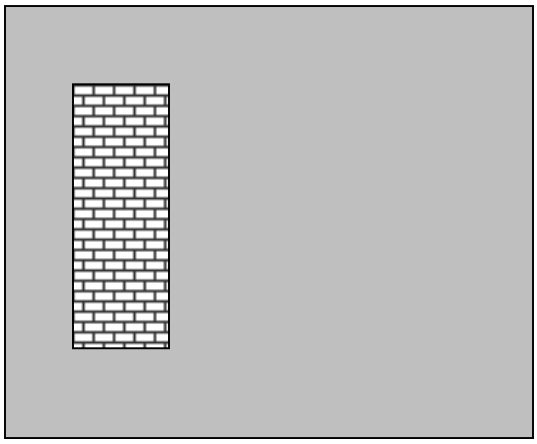


Multi-Layered Mask Centering

If making multi-layered masks, make sure that all layers have the same center. When the design data is converted, the conversions software automatically centers the design.

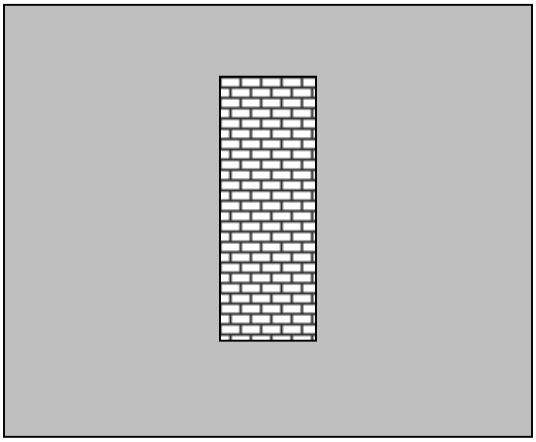


Design 1. A L-EDIT design that takes up most of the mask area, and is perfectly centered on the mask.

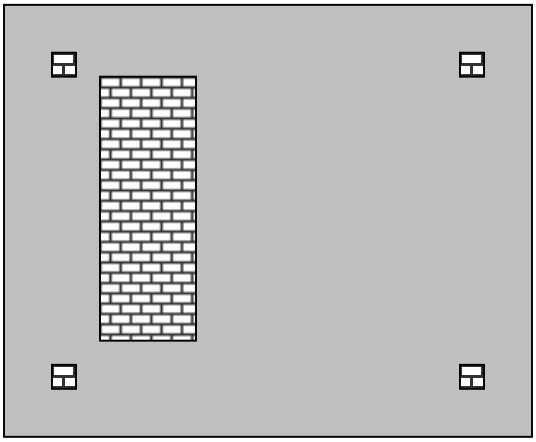


Design 2. A L-EDIT pattern designed to take up the left area of the mask.

During the automatic centering, Design 1 and Mask 1 will look the same, however Design 2 and Mask 2 will have different centers.



Mask 2. Location of Design 2 on mask after automatic centering.



Design 3 and Mask 3. Because of the squares, both Design 1 and Design 3 have the same center.

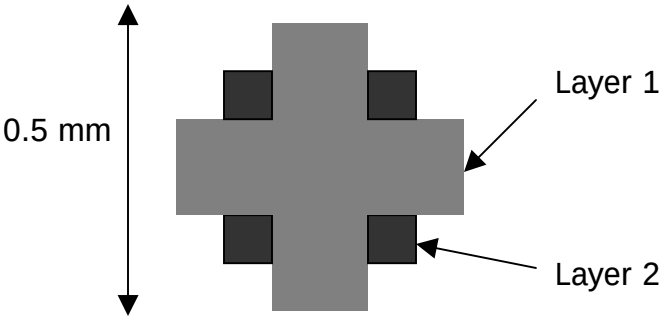
To avoid this problem, place some squares on the outside of your design so that it has the same centering as Design 1. It is important to keep centering in mind, because the Mask Aligners at the NanoFab can only move within a certain range, and if the centering is really off, there will be no way to align the different layers.

Edge Avoidance

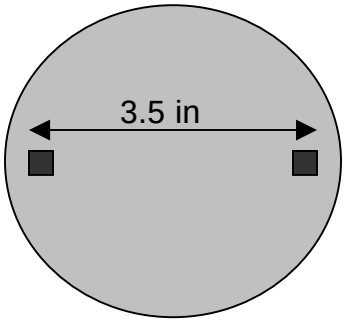
It is best to avoid designing the 2 – 4 mm around the edge of the substrate as 1) resist may build up at the very edge of the substrate and 2) it leaves room for handling processed wafers with tweezers without having to worry about damaging features.

Alignment Marks

Alignment marks are very important for multi-layered masks. These marks must be transferred onto your substrate so that they can be used for alignment of other layers. The alignment marks should be at least 0.5 mm^2 and should have an 2mm opening around them so they can be easily found and aligned.



Typical alignment marks for a 2-layer mask where the cross is layer 1 and the squares are layer 2.



Alignment marks should be placed near the edge and along the centerline of the substrate, ex. on a 4 in silicon wafer.

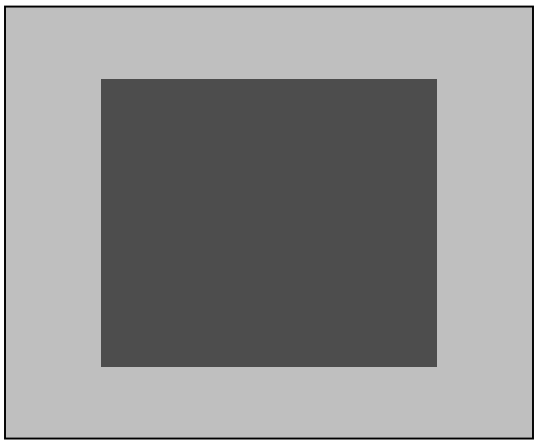
Note: For more examples of alignment marks see Day 3 of the Mandatory Safety Course.

Write Time Considerations

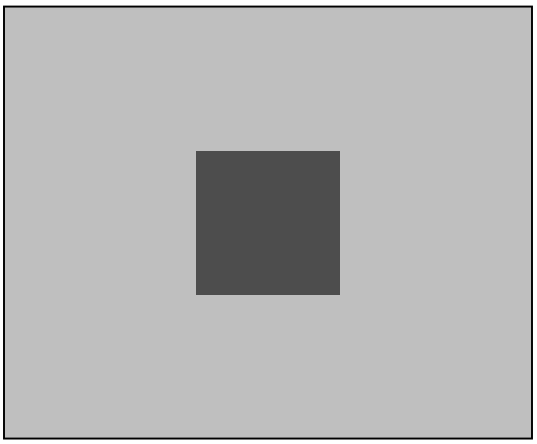
The length of time is takes to write a mask depends on your feature size, the size of your design, and the orientation of your design.

The smaller your minimum feature size, the longer the mask will take to write. This is especially noticeable with features below 2 μm.

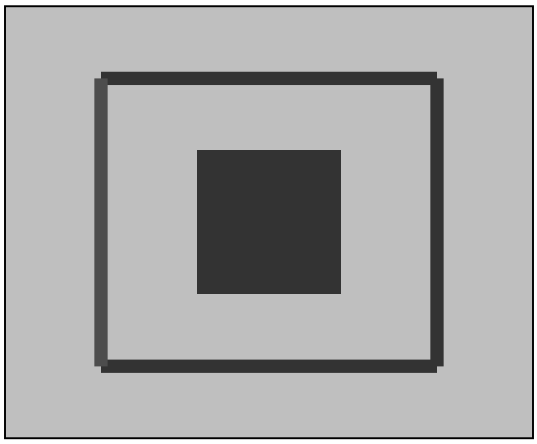
The smaller your design area the less time it will take to write.



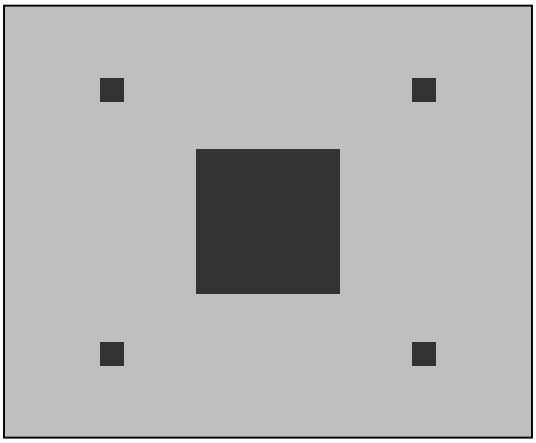
Mask 1. A typical design that takes up most of the mask area.



Mask 2. This design is much smaller, therefore it will take considerably less time to write then Mask 1.

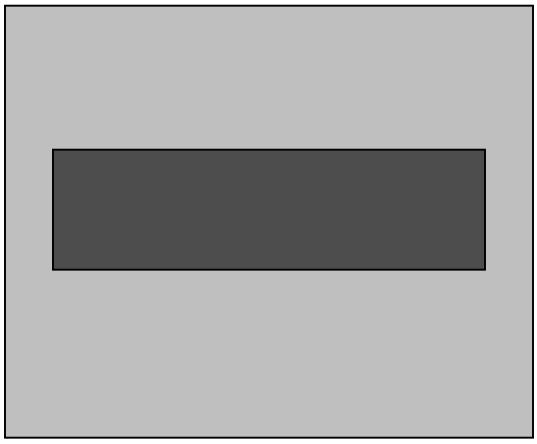


Mask 3. Although this design takes up less actual mask area, it outlines an area that takes up the same space as Mask 1. Therefore Mask 1 and Mask 3 will take the same time to write.

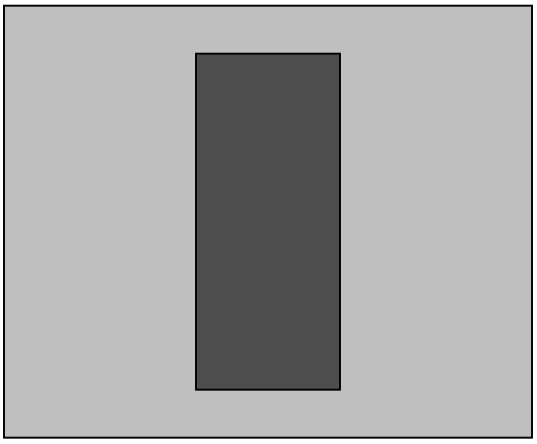


Mask 4. This mask will have a longer write time compared to Mask 2, however it will be much shorter than Masks 1 and 3. The pattern generator only writes where it has to, and because the design is not outlined, it can skip over the areas with nothing in it.

A vertical orientation of your design will take less time to write than a horizontal orientation because the conversion software defines stripes vertically. The pattern generator is able to optimize its writing, therefore it can skip over areas that are blank.



Mask 5. Because stripes are defined vertically, there are about 3 times more stripes to write in Mask 5 then in Mask 6. This mask will take roughly 3 times longer to write.



Mask 6. Optimization of this design allows the pattern generator to skip over the blank areas to the left and right of the design. This will significantly decrease the write time.

Note: If the design is able to be orientated vertically, the final design can be flipped in L-EDIT or in the conversion process.