William Schrab
3/6/26
ME5241

Wireless Light Remote Injection Mold Design

Design

Injection molded parts are the most efficient way to produce large amounts of plastic parts and they are used in the vast majority of plastic components and products. This design document outlines the design and fabrication of 3 of the plastic parts of a wireless light remote control. The design is inspired and based on the IKEA STYRBAR (figure 1.) which comes in both a fully plastic and a plastic with a metal front variant. I used the fully plastic model for getting an idea and dimensions, however I designed the 3 plastic parts from the metal plated one, i.e. the front plate is not injection molded here. To recreate the functionality of snapping to the wall plate a magnetic design is used in which the injection molded wall mount will have a metal inset in its back.

Figure 1. IKEA STYRBAR remotes this design is based on

Discussion of design

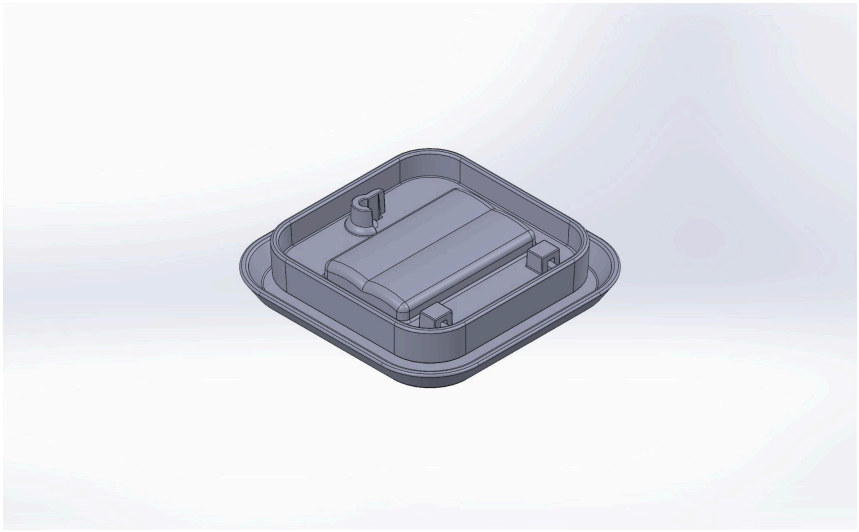

Figure 2. Remote assembly

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The design of the remote body has a body thickness 0.08 inches which is in the standard abs range of 0.045 in. - 0.140 in. The body has a compartment in the center of it for 2 batteries to be placed in its back along with holes for metal contacts to be placed to connect the batteries to the internal electronics. The remote also has a keyhole shape to allow a back to be placed over it and locked into place. The remote contains space for magnets to be placed inside with a small amount of adhesive after injection molding to allow for the remote to stick to its wall mount, or other ferromagnetic metals. Figure 3 shows a section view of the main remote body showing the rounded cavities for batteries to sit in with the red arrow. The blue circle shows the hole that the backplate of the remote's hooks will sit in. The circle on the left most side of the body is where a "key" shape will pass through the main body and attach to the backplate holding the body and its back together.

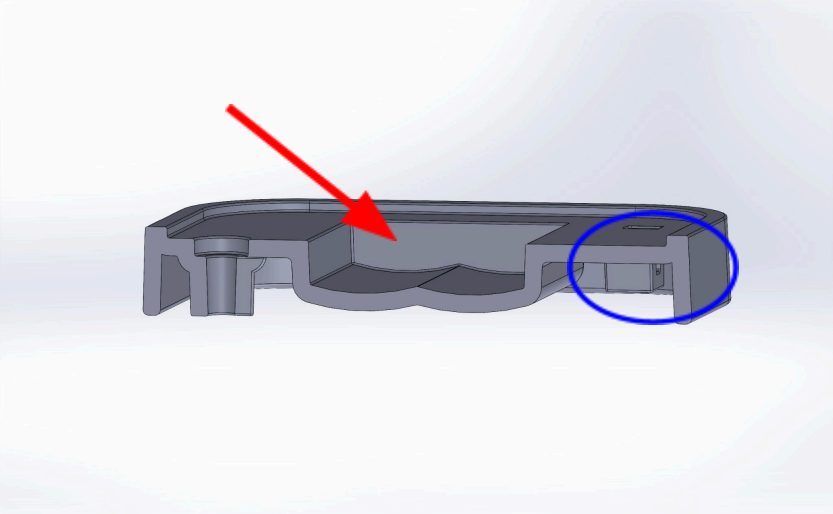

Figure 3. Section view of the middle of the main remote body

The design of the back of the remote was fairly simple, again with a wall thickness of 0.08 inches. For the shape, it matches the profile of the inside of the remote's rear side and contains a hole allowing for the "key" to be placed for connecting to the front main remote body. The back also has 2 hooks for securing the back to the remote securely. The side profile of one of these hooks can be seen below in figure 4, with a slight draft to its sides and a small angle at its corner making it not a perfect L shape which will allow for better plastic flow in the mold (angled corner is circled in red). This part is an overhang but due to its fairly small and thin nature can be still done with a pin system and still passes the Protolab design review.

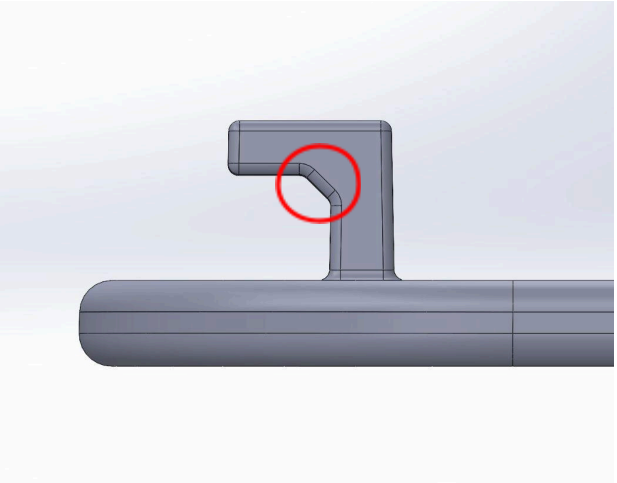

Figure 4. Close up of hook on the remote back

The wall mount is a thin injection molded piece with walls that curl up around the edges and contains space for 2 screws or nails to secure it to a wall permanently. The wall mount has an offset square in the back of it that allows for attaching a metal plate through a small amount of glue. The glue is only there for assembly and ease of installation purposes as once the wall mount is attached to the wall it will hold the metal plate firmly between itself and the wall. Since the wall mount's walls are very thin the magnets in the main remote body will still be able to successfully magnetize to and stick to the body.

Discussion of assembly

To assemble the final remote control the electronics will need to be placed into the main body and the buttons and metal face plate will also need to be put into place onto these buttons. Magnets then need to be glued into place inside of the main body, making sure that they are facing the correct direction. Batteries will then need to be placed into the back of the main body. For the back plate of the remote the key mechanism will need to be screwed into place and then the back plate will need to be put onto the back of the main remotes body. For the wall mounting plate a small square metal plate will need to be attached to the back of the wall mounting plate.

Fabrication

Injection mold analysis from Protomold

Protolabs injection mold analysis software was used to get an analysis for the injection molding of each of the 3 parts. Mold life was set to limited for prototyping purposes of the part, but for full production the cost per mold goes up by roughly $1,000 per mold. The price breakdown is shown below in table 1 with a total cost for all 3 molds of $11,838.00 and $8.12 per plastic part made. Two injection molding analyses were done with the first showing a few issues with fillets causing undercuts and a few drafting issues. A more in depth quote is available on the first and second pages of appendix 3.

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Table 1. Cost Breakdown of injection molded parts

Part	**Mold Cost ($ USD)**	**Plastic Price per Part ($ USD)**
Main Remote Body	3,655.00	2.60
Remote Back	5,013.00	2.92
Wall Mount	3,210.00	2.60
Total	11,878.00	8.12

Protolabs returns a part analysis which is pages 3 and beyond in appendix 3. The wall mount and remote back parts both returned acceptable analyses. The only issues for the wall plate were a lack of draft one 2 sections, and a small unpolishable part. The lack of draft was not an issue as it meant no texture could be applied, but no texture was wanted. For the remote back there were a few parts that could use slightly more filleting/rounding, but more importantly draft could have been used where a slider was being used to create the clips which requires an overhang. This lack of draft is shown in figure 5 or in the 3rd document of appendix 3.

As the side-pull pulls away from the part after molding it may leave marks in the red section, this could be fixed by adding a slight draft in the final version. Although slight marks are not a big deal as the part will face the inside of the battery compartment and isn't a visible surface of the part.

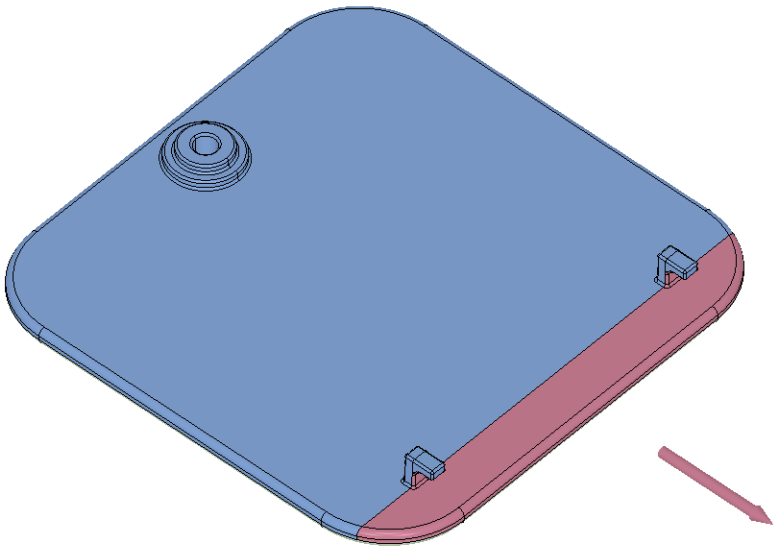

Figure 5. 3D view of remote back with arrow showing where slider will be pulled.

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The main remote body has the most noted flaws according to the mold review by Protolabs. The main feature which requires a change before molding is shown below in figure 6. The areas highlighted in red cannot be formed as they are fillets that span the parting lines of the mold which will cause an undercut. To fix this the fillets must be removed and consistency in those corners isn't going to be guaranteed. This is acceptable though as this is an internal component of the remote body and having sharp or rounded edges has no impact on the user experience and the user should never access this internal component once the metal remote cover is installed.

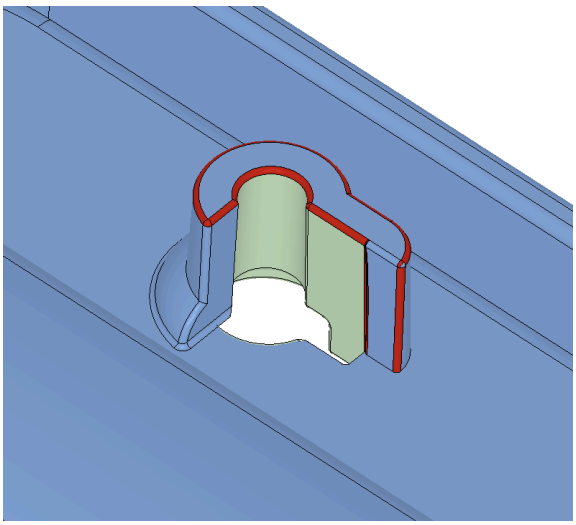

Figure 6. Main body of remote where RED highlights areas that can't be formed

Picture of assembled prototype

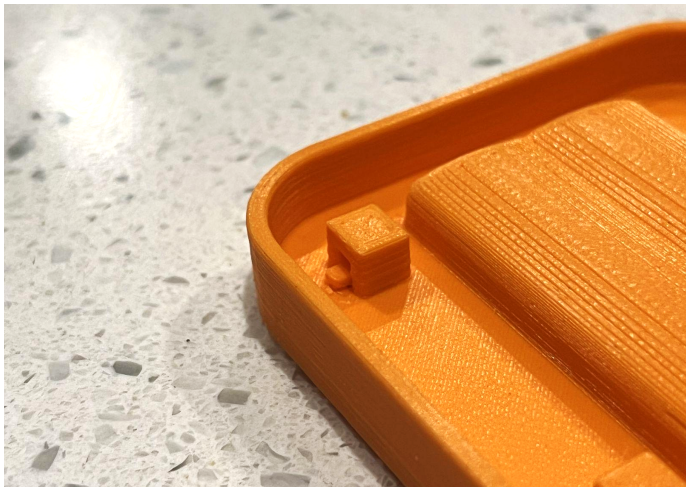

Figure 7. Close up of hook to attach back of remote

Figure 8. Fully assembled 3D printed remote (minus metal face plate)

As can be seen in both figures 7 and 8 above, are the fully assembled remote body, back, and wall mount, along with a close up of how the remotes back clips onto the main remote body. In the close up one clip is hooked in, however the clip that isn't pictured has snapped off. This is most likely an artifact of 3D printing as while removing supports, the clip broke off due to the weak strength of prints when pulling orthogonally from the print layers. In a final injection molded part the design would have wider clips so they are less prone to breaking.

First article inspection

The main body has 4 easily measurable dimensions as shown in the second drawing in the appendix. Being the 2 outside edges lengths and the 2 inside lengths. The back of the remote also has 4 easily measurable dimensions, 2 being its widths in 2 directions and 2 being the diameters of the bumps on the front of the remote's back plate. The wall mount also has 4 easily measurable dimensions being the 2 outer widths of the protruded square in its center and the 2 outer widths of the entire mounts. The measurements of the 3D printed parts won't exactly correspond to those of the injection molded part, however an attempt can still be made to compare.

The main body is measured to a square 2.49x2.49 compared to the designed 2.53x2.53 inches external and an internal measurement of 2.34x2.34 compared to the designs 2.28x2.28 inches. The main body with a smaller outside and larger inside than intended means that the 3D printed remote's walls are thinner than the true injection molded version. For the rear wall plate the square dimensions are 2.28x2.28 inches compared to the models 2.30x2.30 inches meaning this part is also smaller in its easiest to measure and compare dimension. The final part, the wall plate, measure out to 3.06x3.06 inches which does perfectly align with the cad model, which could potentially be due to the sloped nature of the print causing to to bend down and out while printing, giving it a larger footprint than expected from the injection molded version. The interior

raised square in the wall mount measured 1.60x1.60 inches compared to the expected 1.65x1.65 inch CAD model which follows the general trend of being smaller than designed.

Conclusion

This project showed the design, analysis, and prototyping of designing a wireless light remote body for injection molding. The components aren't production ready as mounts for circuits couldn't be accurately measured without breaking the original IKEA part this was based on. However, this design successfully shows principles of injection molding and CAD modeling. Important features of the design include magnetic mounting, a key type design to lock the back in place, and clips that allow the back of the remote to snap into place. The Protolabs analysis and quote shows the feasibility of manufacturing and with only 1 necessary change, and a few quality changes, this part could be injection molded for prototyping at $11,878.00 for all 3 molds.

The 3D printed version also showed the feasibility of the design with the back plate truly snapping into place, despite one of the hooks breaking off when removing supports from the 3D print. The 3D printed parts were smaller than the originally designed parts, but with proper injection molding this "shinkage" can be avoided. In future versions of the design wider clips to add rigidity would be a nice addition. Also a better layout for the electronics inside to body and more accurate points for electronic connections would be welcome additions.

References

https://www.ikea.com/us/en/p/styrbar-remote-control-smart-white-80488370/
https://www.protolabs.com/materials/comparison-guide/?filter=injection-molding-materials

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Appendix 1

Media

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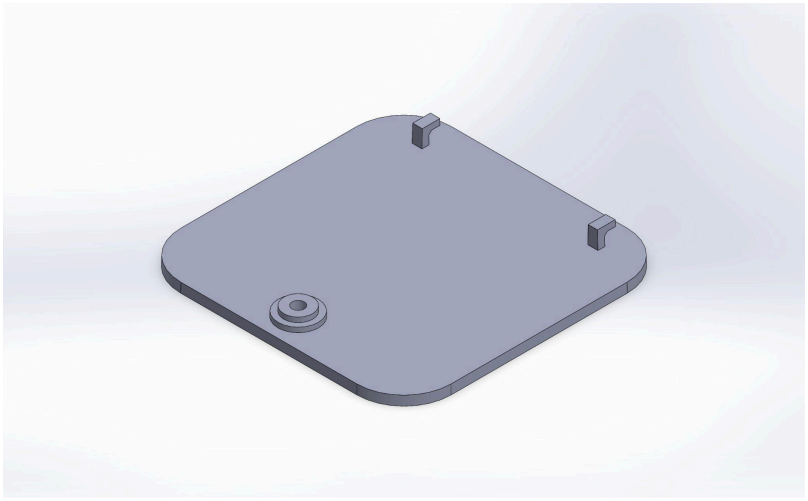
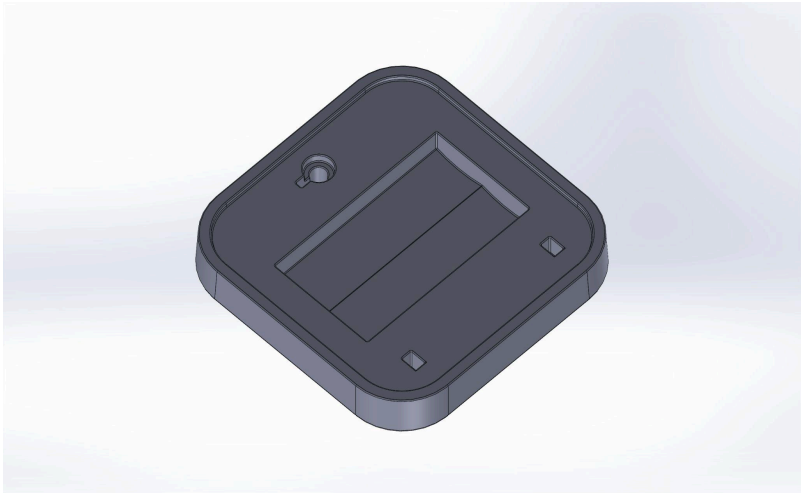
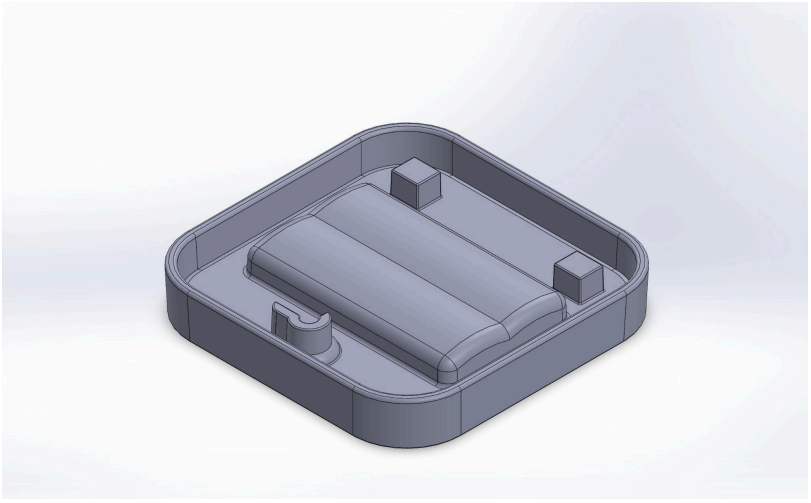


Back orthographic view



Remote front orthographic view



Remote back orthographic view

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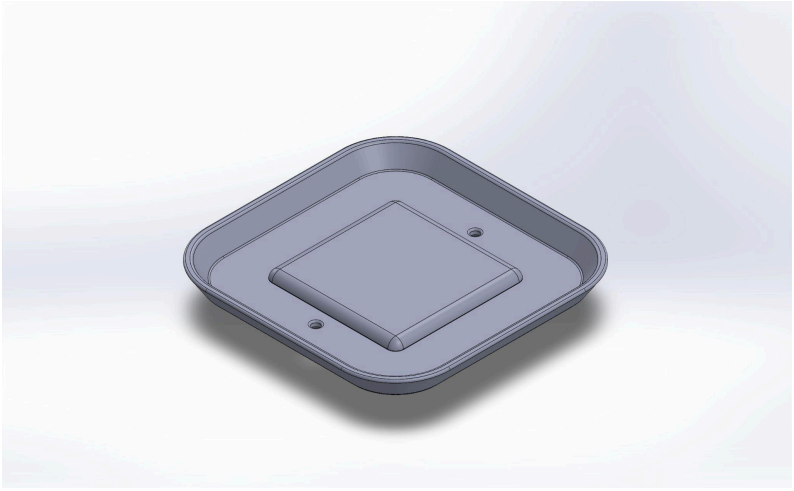
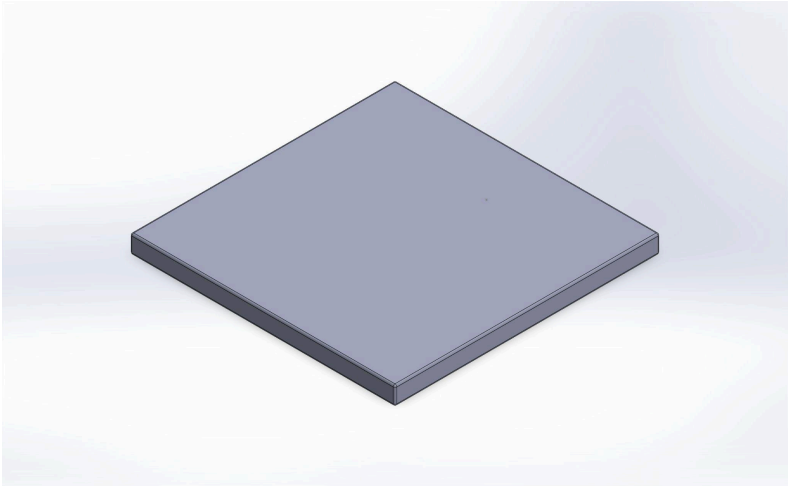


Wall mount orthographic view



Metal plate orthographic view

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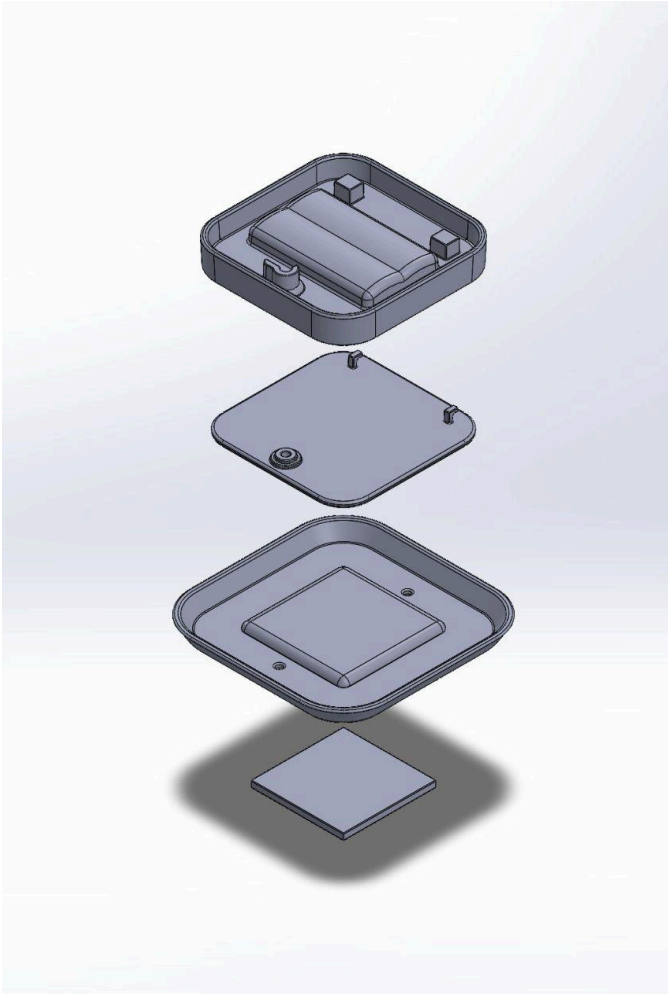
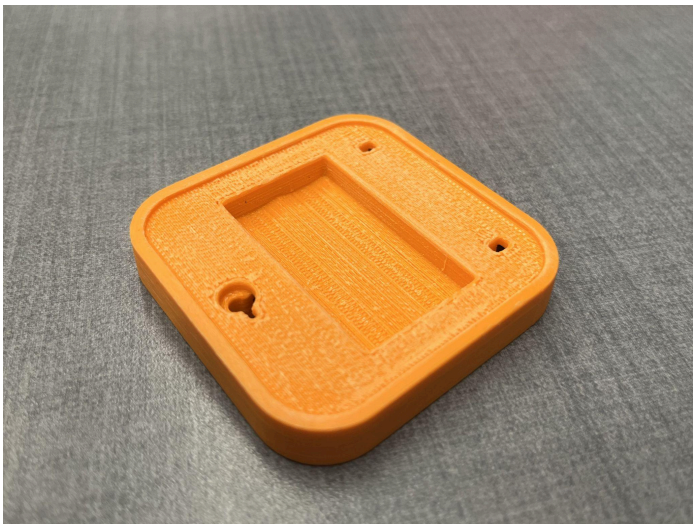


Remote assembly exploded view



3D printed remote body

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3D printed remote back

3D printed wall mount

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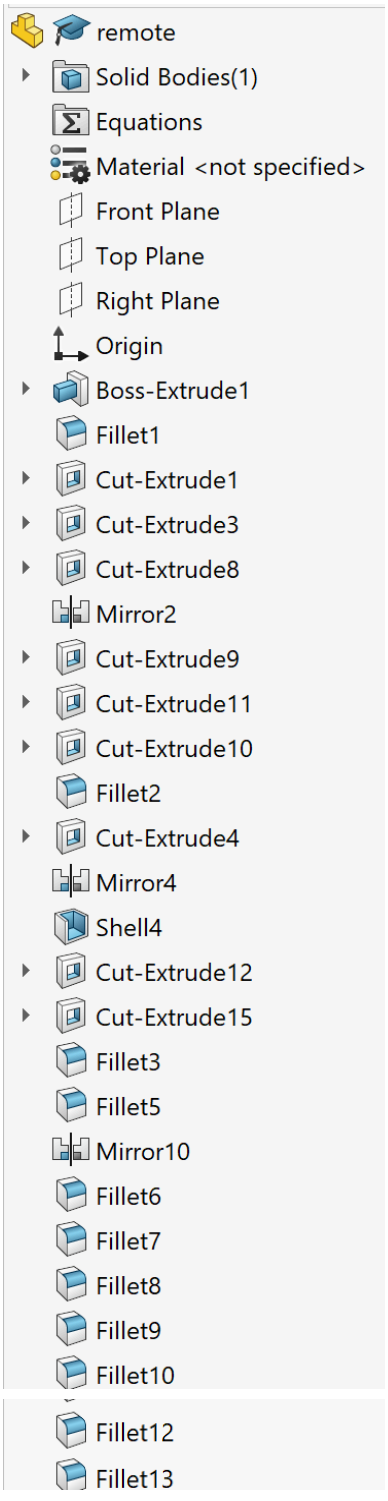
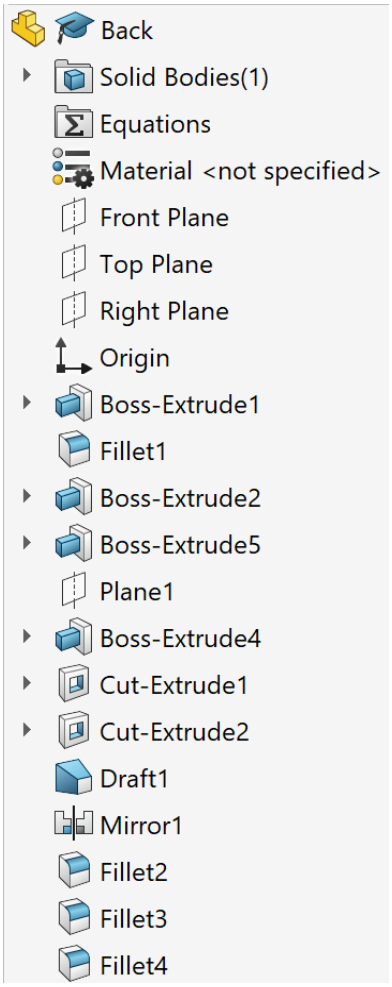
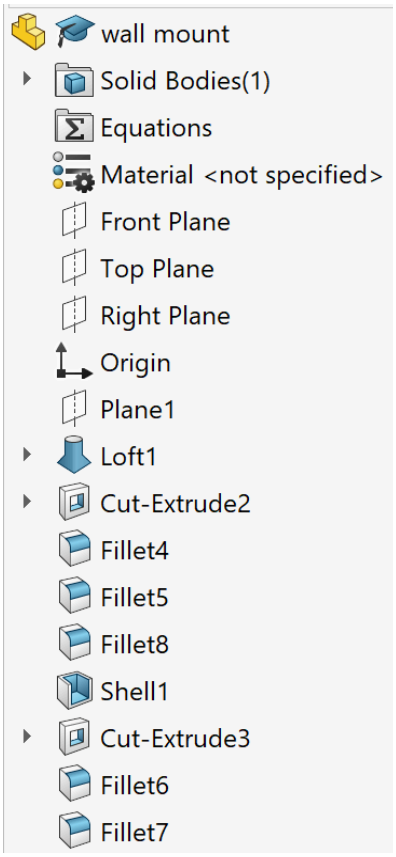
Remote Body	Remote Back	Wall Mount
		

Table 2. Feature Tree for Solidworks models of each part

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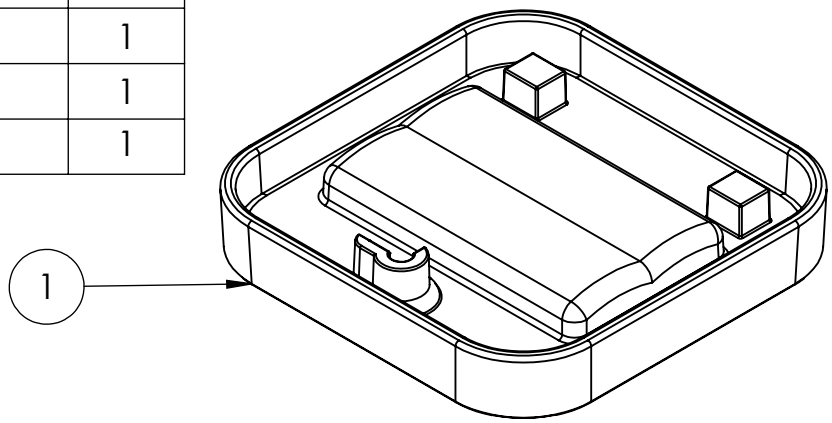
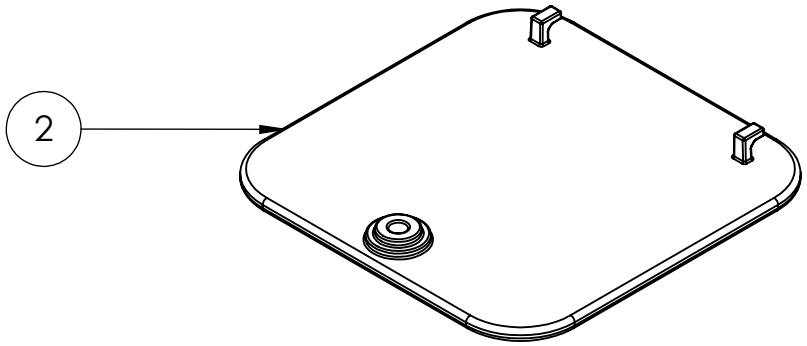
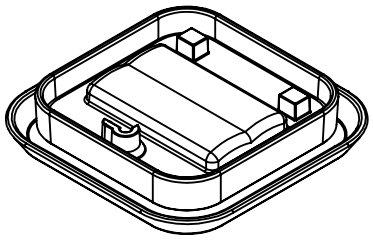
Appendix 2
CAD Drawing

ITEM NO.	PART NUMBER	QTY.
1	remote	1
2	Back	1
3	wall mount	1
4	metal plate	1







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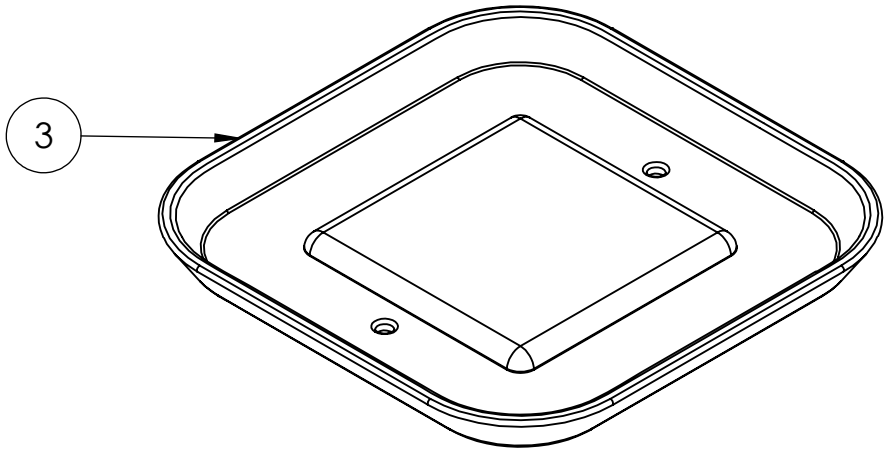
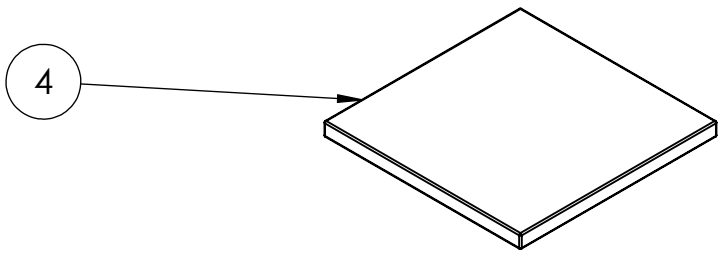


NOTE: METAL PLATE, ITEM NO. 4, REQUIRES LIGHT GLUEING INSIDE OF CAVITY IN WALL MOUNT, ITEM NO. 3



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			MFG APPR.			
		MATERIAL ABS & IRON	Q.A.			
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APPLICATION		DO NOT SCALE DRAWING				SIZE A / DWG. NO. RemoteASM_dwg / REV. 02 / SCALE:1:1 / WEIGHT: / SHEET 1 OF 1

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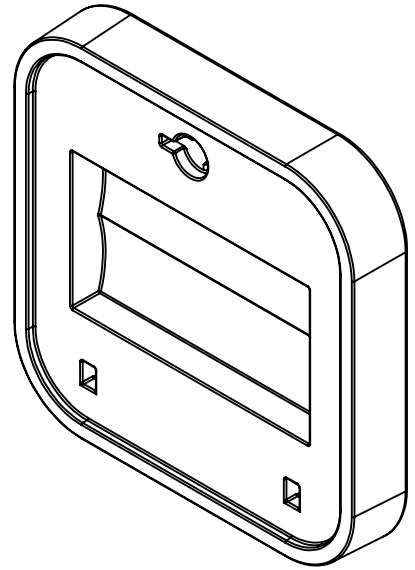

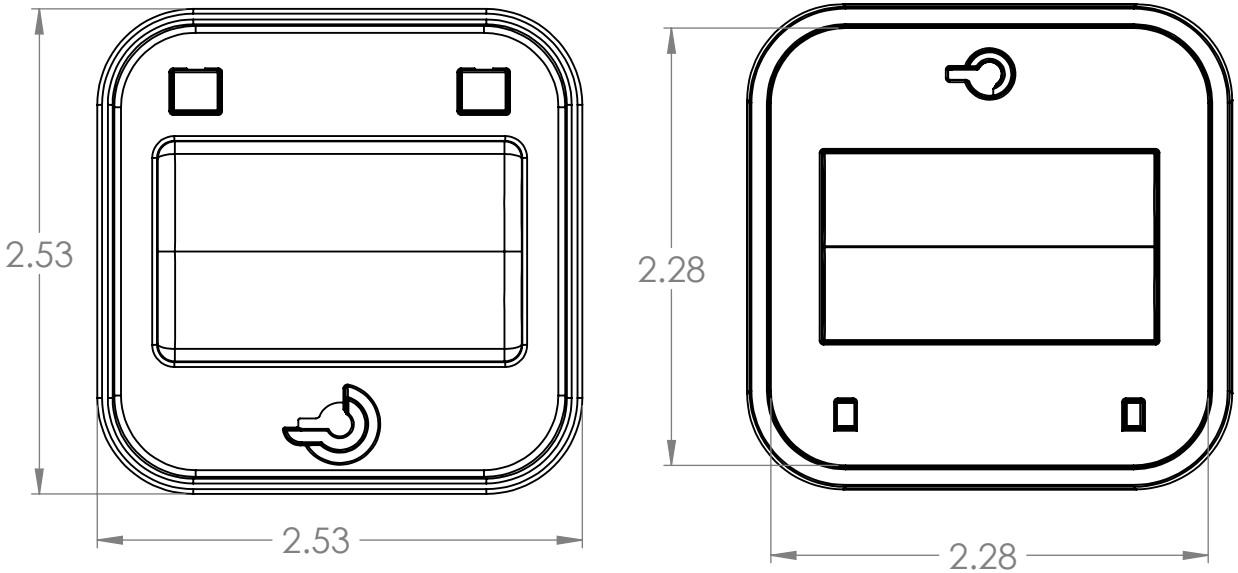

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TITLE:

Remote Main Body

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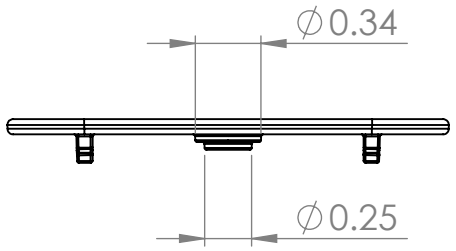

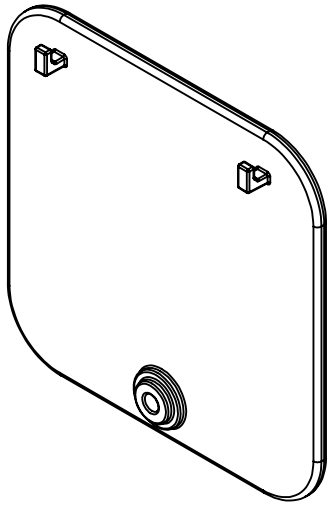

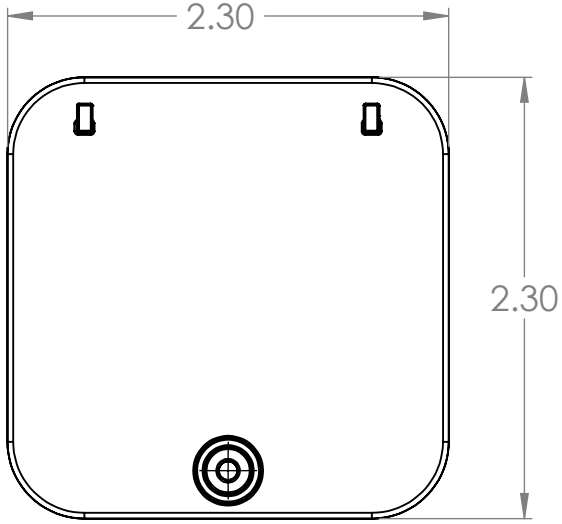

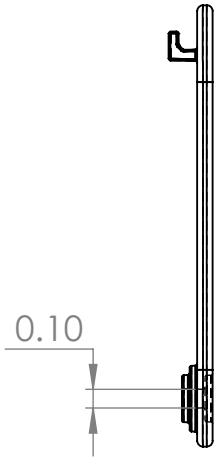

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TITLE:

Remote Back

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A	Back_dwg	01

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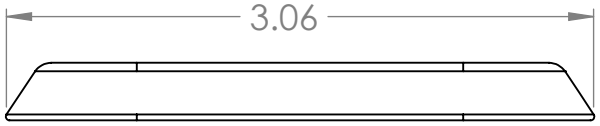

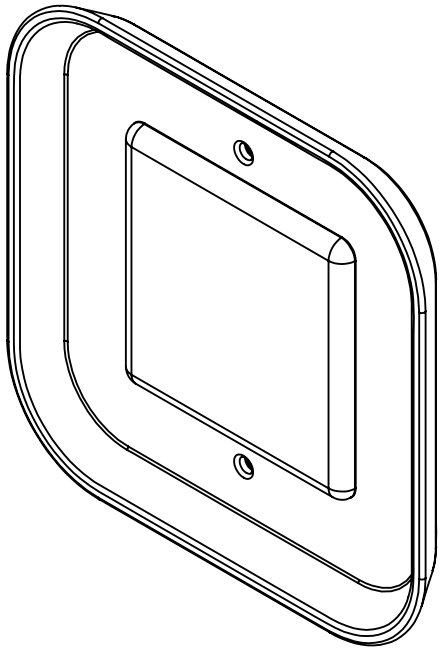

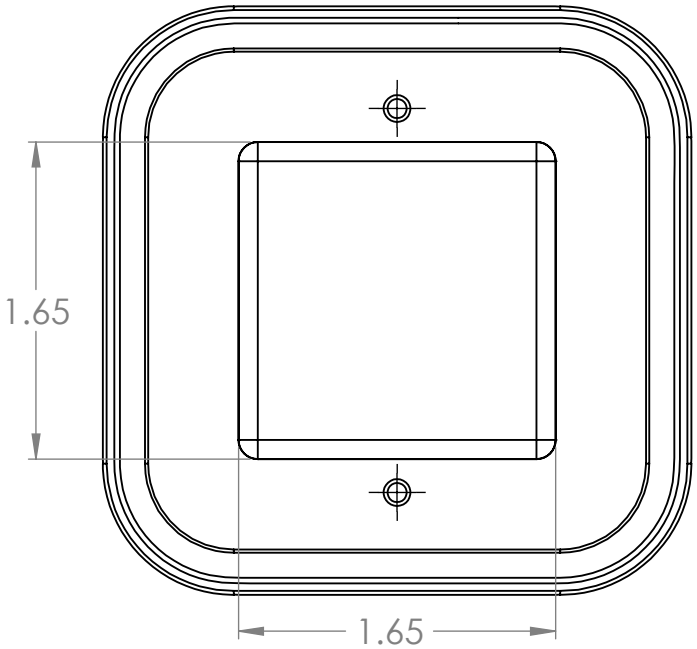

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TITLE:

Wall Mount

SIZE	DWG. NO.	REV
A	wall mount_dwg	01

SCALE: 1:1 | WEIGHT: | SHEET 1 OF 1

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Appendix 3

Protolabs Bill and Analysis

PROTOLABS
Manufacturing. Accelerated.

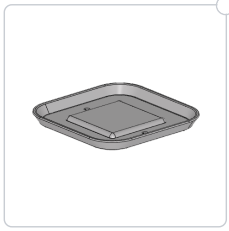
Quote Date: March 6, 2026

Quote 4432-453

Prepared for University of Minnesota

Injection Molding 3 Parts

ITAR/Export Controlled: No



wall mount.SLDPRT

1773-5904-001
CAD Revision: 1
Mold Life: I'll decide later
ABS : LG Chem HI121H-0B585 WT (Whi...
White (Original Material Color)
Cosmetic: PM-F0
Non-Cosmetic: PM-F0
Material Tolerance: +/- 0.002 in./in. (0.0...
X: 3.065in Y: 3.065in Z: 0.300in
Machining Tolerance: +/- 0.003 in. (0.07...

This part needs to be configured

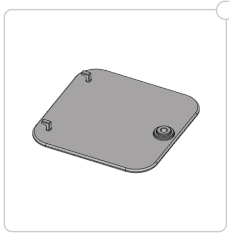
Sample Quantity

25

Want your price?

Return to the configuration page and update

Day	Day	Day	Day	Day	Day



Back.SLDPRT

1252-8064-001
CAD Revision: 1
Mold Life: I'll decide later
ABS : LG Chem HI121H-0B585 WT (Whi...
White (Original Material Color)
Cosmetic: PM-F0
Non-Cosmetic: PM-F0
Material Tolerance: +/- 0.002 in./in. (0.0...
X: 2.298in Y: 2.298in Z: 0.228in
Machining Tolerance: +/- 0.003 in. (0.07...

This part needs to be configured

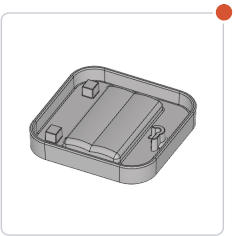
Sample Quantity

25

Want your price?

Return to the configuration page and update

Day	Day	Day	Day	Day	Day



remote.SLDPRT

1066-8018-001

CAD Revision: 1

Mold Life: I'll decide later

ABS : LG Chem HI121H-0B585 WT (Whi...

White (Original Material Color)

Cosmetic: PM-F0

Non-Cosmetic: PM-F0

Material Tolerance: +/- 0.002 in./in. (0.0...

X: 2.526in Y: 2.526in Z: 0.400in

Machining Tolerance: +/- 0.003 in. (0.07...

⚠ This part needs your attention:

Sample Quantity

25

Select mold life to see pricing

See pricing options and select mold life

Day	Day	Day	Day	Day	Day

Shipping To

55126

Shipping Options

No carrier account

Order Summary

Your part(s) need your attention.

Manufacturing Analysis

Need Help?

remote.SLDPRT

Revisions Required

We found issues we can't work around in our analysis of remote.SLDPRT for Injection Molding with ABS. Items marked CAD Revision Required must be changed in order for us to manufacture the part. All other items are optional or informational.

What we need from you:

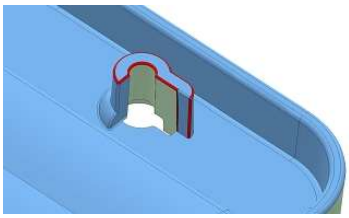
⚠ Upload revision or remove part from quote

1 Fillet Spans Parting Line — Required Change

The fillets highlighted in RED cannot be formed as they span the parting line.

⚠ This is a required change

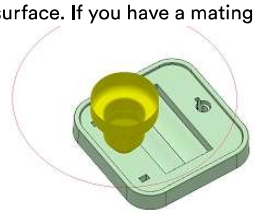
These fillets create an undercut that cannot be formed using standard toolpathing techniques.



2 Hot Tip Gate

Your part is gated using a hot-tip gate highlighted in YELLOW.

Gate(s) will be trimmed after molding leaving a small vestige, typically within 0.005 in. (0.13mm) of the surface. If you have a mating part, verify gate location alignment with your mating part.

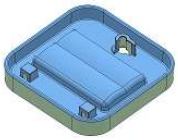


3 Radius

Sharp corners in your geometry will be rounded due to the mold machining process.

Corners that will have a radius due to the milling process are color coded as follows:

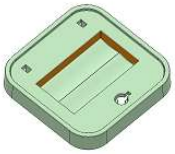
- 0.011 inches
- 0.016 inches
- unformed features



4 Retention

We recommend adding 3° of draft to cavity-side features on all injection-molded parts.

The features highlighted in ORANGE have less than 3° of draft. Without draft in this area, there may be issues such as drag marks, distortion from ejection stresses or other undesired effects.



5 Texture

Insufficient draft may cause issues during ejection leading to part distortion and cosmetic flaws, as well as mold damage.

Draft is required for textures to remain after a part is removed from the mold.

Unmarked faces can have a T1 or T2 texture applied. Yellow faces (3–5° of draft) can have a T1 texture applied. Red faces (less than 3°) cannot be textured.

> View Area 1

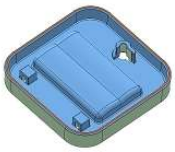
View Area 2

6 Unpolishable Areas

ORANGE color coding indicates areas on the part we are unable to adequately polish.

The appearance of unpolishable areas may not match the selected finish.

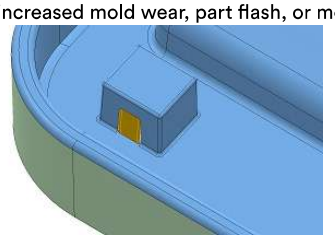
Reduce the depth or widen the features highlighted in orange.



7 3° of Shutoff Draft

3° of draft for clearance in shutoff areas is recommended.

Orange surfaces indicate areas where the shutoff has insufficient draft (too vertical), which may result in increased mold wear, part flash, or mold damage.



Manufacturing Analysis

Need Help?

Back.SLDPRT

Please Review

We found non-critical issues in our analysis of Back.SLDPRT for Injection Molding with ABS. You can review the details below.

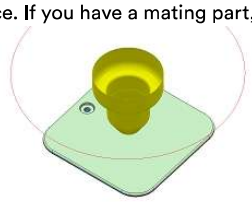
What we need from you:

- Review advisories and click Done
- Accept gate and ejector layouts

1 Hot Tip Gate

Your part is gated using a hot-tip gate highlighted in YELLOW.

Gate(s) will be trimmed after molding leaving a small vestige, typically within 0.005 in. (0.13mm) of the surface. If you have a mating part, verify gate location alignment with your mating part.



2 Radius

Sharp corners in your geometry will be rounded due to the mold machining process.

Corners that will have a radius due to the milling process are color coded as follows:

- 0.011 inches
- unformed features

> View Area 1

View Area 2

3 Texture

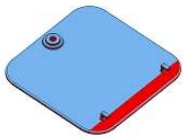
Insufficient draft may cause issues during ejection leading to part distortion and cosmetic flaws, as well as mold damage.

Draft is required for textures to remain after a part is removed from the mold.

Unmarked faces can have a T1 or T2 texture applied. Yellow faces (3–5° of draft) can have a T1 texture applied. Red faces (less than 3°) cannot be textured.

> View Area 1

View Area 2



4 Unpolishable Areas

ORANGE color coding indicates areas on the part we are unable to adequately polish.

The appearance of unpolishable areas may not match the selected finish.

Reduce the depth or widen the features highlighted in orange.

5 Side-Pull Used

A side-pull will be used to accomplish molding of your part.

Solid arrows and faces with corresponding colors indicate undercut features that will be formed by using side-pull(s).

6 Draft Suggestion

Draft aids in milling and ejection of this part.

The areas indicated show faces with insufficient draft. We suggest a minimum of 1° draft in order to avoid possible cosmetic defects during milling and ejection.

Manufacturing Analysis

Need Help?

wall mount.SLDPRT

Please Review

We found non-critical issues in our analysis of wall mount.SLDPRT for Injection Molding with ABS. You can review the details below.

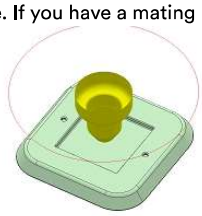
What we need from you:

- Review advisories and click Done
- Accept gate and ejector layouts

1 Hot Tip Gate

Your part is gated using a hot-tip gate highlighted in YELLOW.

Gate(s) will be trimmed after molding leaving a small vestige, typically within 0.005 in. (0.13mm) of the surface. If you have a mating part, verify gate location alignment with your mating part.



2 Texture

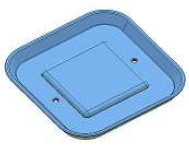
Insufficient draft may cause issues during ejection leading to part distortion and cosmetic flaws, as well as mold damage.

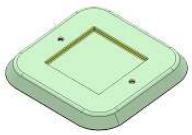
Draft is required for textures to remain after a part is removed from the mold.

Unmarked faces can have a T1 or T2 texture applied. Yellow faces (3–5° of draft) can have a T1 texture applied. Red faces (less than 3°) cannot be textured.

> View Area 1

View Area 2





3 Unpolishable Areas

ORANGE color coding indicates areas on the part we are unable to adequately polish.

The appearance of unpolishable areas may not match the selected finish.

Reduce the depth or widen the features highlighted in orange.