Tech Tips

UL 94 Classification and Flame-Retardant Thermoplastics

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UL 94 is a plastics flammability standard released by the Underwriters Laboratories (USA). The standard classifies plastics according to how they burn in various orientations and part thicknesses from the lowest flame-retardant to most flame-retardant in six different classifications.

UL 94 RATING	DEFINITION OF RATING
HB	Slow burning on a horizontal part
V-2	Burning stops within 30 seconds on a part allowing for drops of vertical flammable plastic.
V-1	Burning stops within 30 seconds on a vertical part allowing for drops of plastic that are not inflames.
V-0	Burning stops within 10 seconds on a vertical part allowing for drops of plastic that are not inflames.
5VB	Burning stops within 60 seconds on a vertical part not allowing for drops of plastic that are not inflames. Test specimens may have a burn-through (a hole may be present).
5VA	Burning stops within 60 seconds on a vertical part not allowing for drops of plastic that are not inflames. Test specimens may not have a burn-through (no hole).

Effects of Flammability

Colorant/Additives: For best results, stick with a base resin with no additives as most additives may not carry a UL rating. If a specific additive is required, you would likely need to work with a compounder that could custom create a flame-retardant blend of the base resin, like color matching, for example.

Part Thickness: UL ratings are measured at various thicknesses and this can drastically change your part's UL rating. If you were looking for a UL 94 V-0 material for a part with thin or thick walls, as shown in the chart below, your part may fail — so pay close attention to wall thickness and material selection.

THICKNESS	NOMINAL VALUE UNIT	TEST METHOD
FLAME RATING: UL		UL 94
0.0295 IN.	V-2	
0.0591 IN.	V-0	
0.0787IN.	5VB	

V-0-Rated Injection Molding Materials

Protolabs offers select materials that have a UL 94 V-0 rating for injection molding and can always run custom materials with approval. These would likely need to be customer-supplied resins as the demand may not be large enough to be added as a stocked resin.

STOCKED MATERIALS WITH UL 94 V-0 OR GREATER	
ABS	Polylac PA-765
ABS/PC	Bayblend FR110, Bayblend FR 3010, Cycoloy C2950 and Cycoloy C6600

LCP	Vectra E130i (30% glass fiber)
PA	RTP 203 FR (20% glass nylon)
PBT	Valox 420SEO (30% glass fiber)
PC	Lexan 940 and Lexan 3412R (20% glass fiber)
PEEK	Victrix 450G
PP	Maxxam FR PP 301
PPS	Ryton R-4 (40% glass fiber)
PPSU	Radel R-5000 NT
TPE	Santoprene 251

Material testing must be completed by UL in order to provide the proper "yellow card" as there are many other classifications available. If you have further questions on materials or whether parts meet UL classifications, please contact our customer service engineering team at 877.479.3680 or customerservice@protolabs.com.

For more information on thermoplastic material properties in general, read our free white paper: Materials Matter: The Material Selection Process.

Guide to Injection Molding

This guide walks you through everything from quoting, design analysis, and shipment to best practices that ensure your model is optimized for molding.

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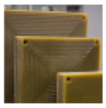

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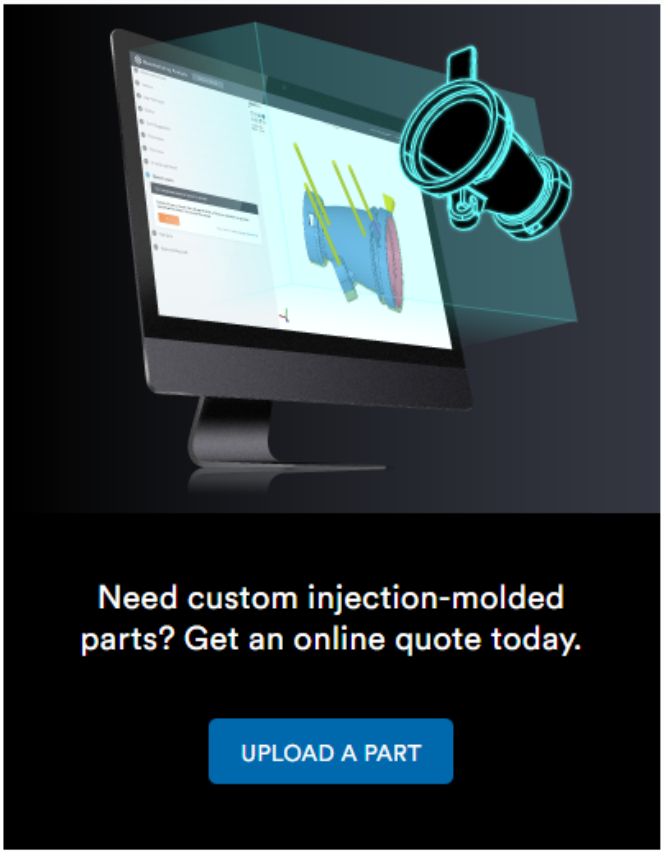

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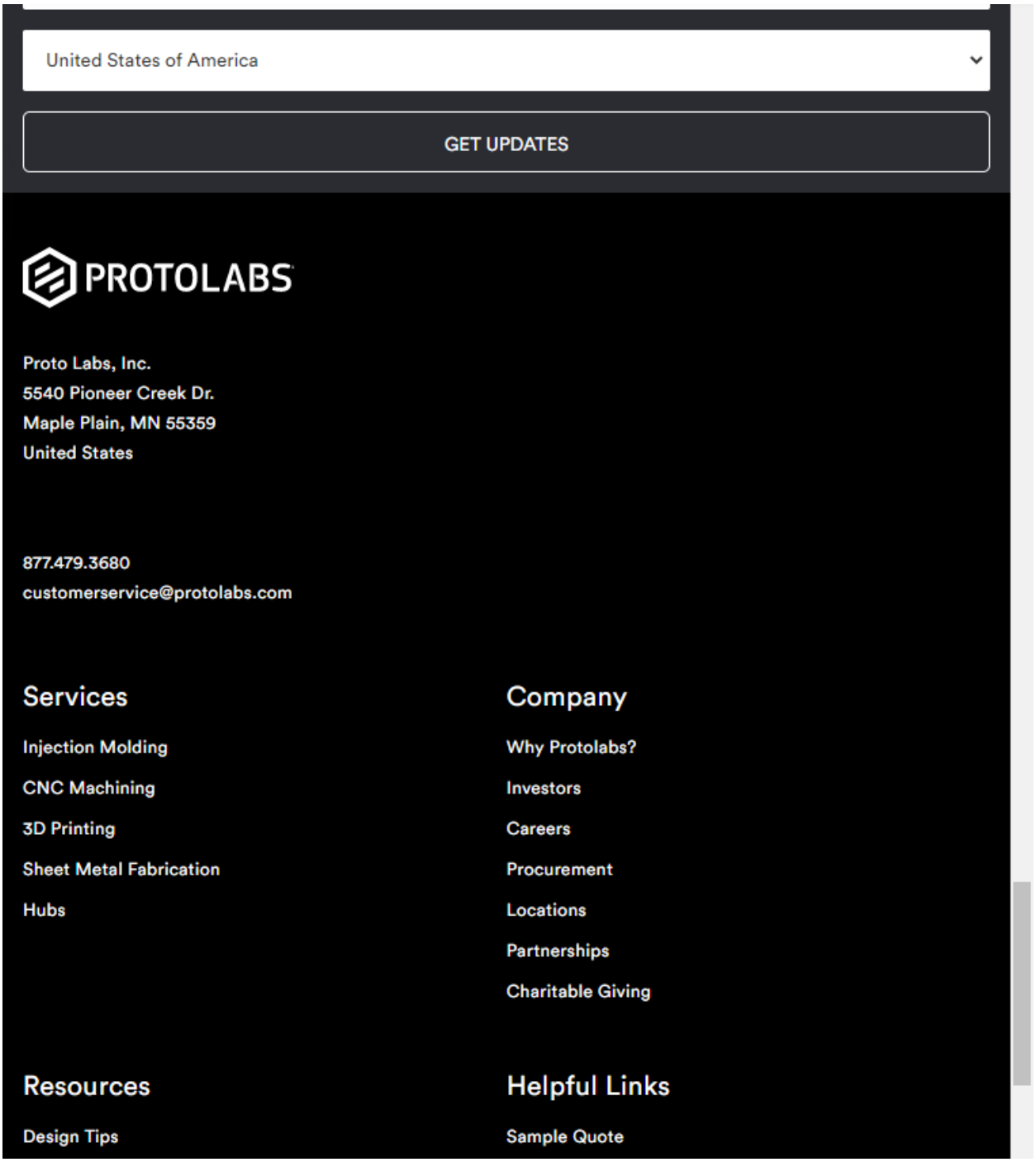
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