

RMS220 Design Guide (TPU)

As with every additive manufacturing (AM) process, the quality of SLS (Selective Laser Sintering) parts is largely determined at the design stage. Key insights on part design and build-nesting strategies are summarized below. Before launching a build, please review the following design guidelines to ensure your parts meet requirements. For part features or nesting configurations not addressed here, or should any process-related issues arise, please contact our after-sales support team.

1. Build Template

For TPU, the process strategy differs between thin-walled parts, lattice (open-cell) parts and thick-walled parts (>3 mm). Thin-walled and lattice parts require a high volumetric energy density so that part performance meets specification; conversely, excessive energy input on thick-walled parts causes severe non-uniform shrinkage, leading to warping, skinning or even detachment from the build platform, which can trigger build failure. Accordingly, two process (parameter) templates have been defined.

Wall Thickness	Template
Thin-walled, medium wall thickness	Lattice
Thick-walled	Solid
Fully nested build (full batch)	Solid

The definition of "Thick-walled" is given in Section 2, "Thin-Walled Sections."

2. Thin-Walled Sections

For TPU, wall thickness strongly affects part performance: too thin a wall may lack strength, whereas a thicker wall raises stiffness and markedly reduces elasticity. A minimum wall thickness of 0.6 mm is recommended.

Wall Thickness Direction	Minimum /mm	Recommended /mm	Remarks
Wall thickness in XY (build-plane direction)	0.6	≥ 0.8	0.6 mm is the process limit, applicable only to non-load-bearing detail features.
Wall thickness in Z (build direction)	0.8	≥ 1.0	Z is the layer-stacking (build) direction, where inter-layer bonding strength is relatively weakest.



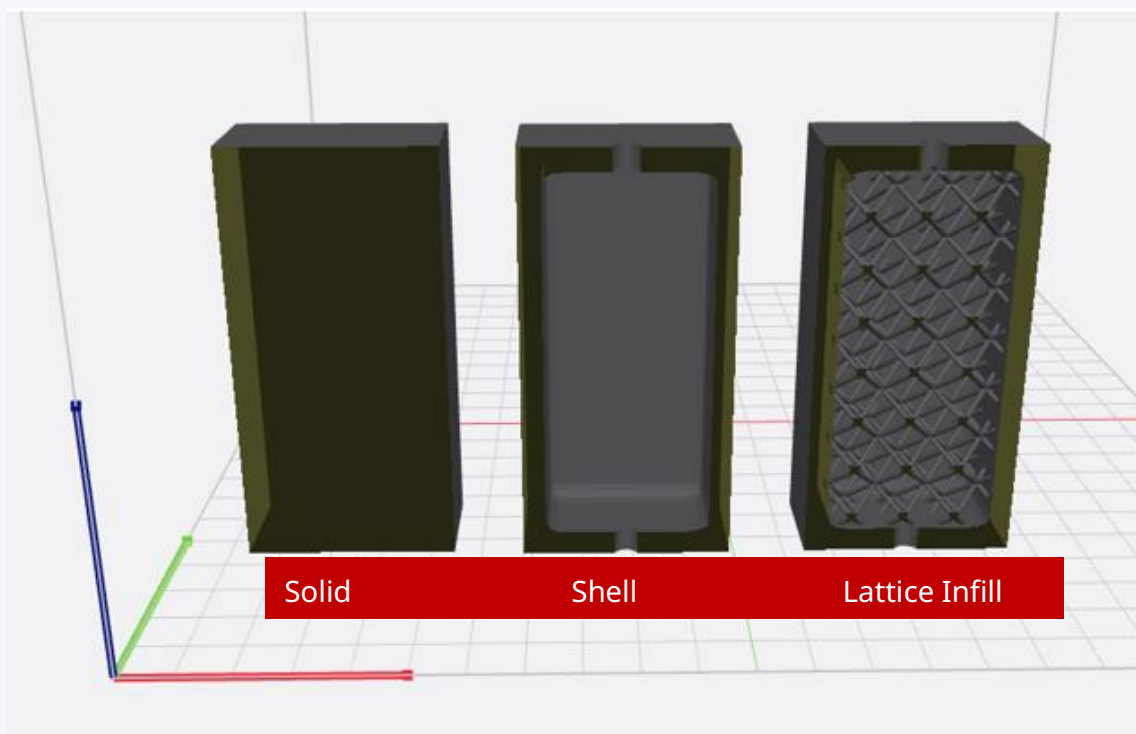
Relationship between wall thickness and elasticity:

- Thin-walled (<1.5 mm): high elasticity, lightweight
- Medium wall thickness (1.5–2.5 mm): balances elasticity and strength
- Thick-walled (>3 mm): increased stiffness, significantly reduced elasticity

Design recommendations: Avoid abrupt changes in wall thickness. A sudden thin-to-thick transition causes localized cooling differences and stress concentrations, which can lead to part distortion or soft/hard interfaces. Use fillets and gradual transitions instead.

3. Solid Parts

For parts with a thickness exceeding 10 mm, shelling (hollowing) is recommended to prevent severe shrinkage distortion during the build, which could otherwise cause build failure. Shelling also greatly reduces material (powder) consumption. A shell wall thickness of 2–3 mm is typically recommended; fully hollowing the part may cause the printed shell to collapse. Internal lattice structures, ribs or other stiffening features can be added to improve overall strength without hindering internal powder removal; alternatively, the shell may be left fully sealed, relying on the unsintered powder trapped in the cavity for internal support.



- In principle, hollow shells should be provided with powder-removal (drainage) ports: port diameter ≥ 8 mm (preferably 10 mm), positioned at the lowest or highest point of the part to ensure complete evacuation of the loose internal powder.



- Fully sealed shells (no powder-removal ports, relying on trapped internal powder for support) are for static load-bearing components only, and "contains internal powder" must be explicitly noted in the order documentation or drawings. Sealed powder-filled structures are not permitted for moving, vibrating or wearable parts — the trapped powder is loose, and under cyclic deformation it causes internal abrasion, accelerating fatigue failure and potentially producing noise and powder leakage.

4. Minimum Feature Size

To ensure crisp, well-resolved features, the following minimum feature sizes are recommended:

Feature Type	Lower Limit /mm	Recommended /mm	Remarks
Raised text/details	0.6	0.8-1.0	Both height and width must be met
Engraved / recessed text/details	0.8	≥ 1.0	If the engraving depth is too shallow (< 0.8 mm), the feature may be filled with powder and become blurred; if vapor-smoothing post-processing is applied, add a further 0.2 mm to the engraving depth.
Vertical through-hole (axis along build direction)	1.5	≥ 3.5	The bottom of the hole may carry sintered burrs; the mating hole should be ≥ 3.5 mm in diameter.
Horizontal hole / blind hole (axis parallel to the build plane)	3.0	≥ 5.0	Under gravity and powder-bed compression, the trapped powder tends to form an elliptical, blind-ended channel that is hard to evacuate; a post-drilling operation to make a through-hole is recommended.
Fine post / strut diameter	0.8	≥ 1.5	Inter-layer bonding strength of slender Z-direction posts is weak; increase their cross-sectional area.



General principle: design holes as vertical through-holes whenever possible; if horizontal holes are unavoidable, keep the blind-hole depth to no more than 3x the hole diameter and connect it to the powder-removal ports.

5. Assembly / Fit Clearance

TPU is an elastomer and is prone to deformation during sintering; when designing assemblies or nesting parts, keep clearances larger than those used for rigid materials.

Type	Min. Clearance /mm	Recommended Clearance /mm	Remarks
Moving-part clearance	0.5	0.6-0.8	Gaps sized for rigid PA12 tend to close up (fuse) in TPU.
Part-to-part clearance	0.5	0.8-1.5	Minimum clearance between a wall and adjacent components
Fastener engagement	-	0.8-1.0mm	Reserve a larger tolerance.

6. Lattice Structure

TPU's high elongation and resilience, combined with a lattice structure, allow weight reduction while delivering precise, tunable elastic response.

Parameter	Recommended Range /mm	Remarks
Unit-cell size	5-8	The smaller the unit cell, the finer the elastic response; too small a cell hinders powder removal.
Strut diameter	1-1.8	Struts that are too thin weaken the part; struts that are too thick make it overly stiff.

Design recommendations:

- First, build a lattice test coupon in the critical area to verify that strength and elasticity meet specification;
- By assigning different lattice densities (porosities) to different regions of the same part, an integrated soft-hard (graded-stiffness) design is achieved.

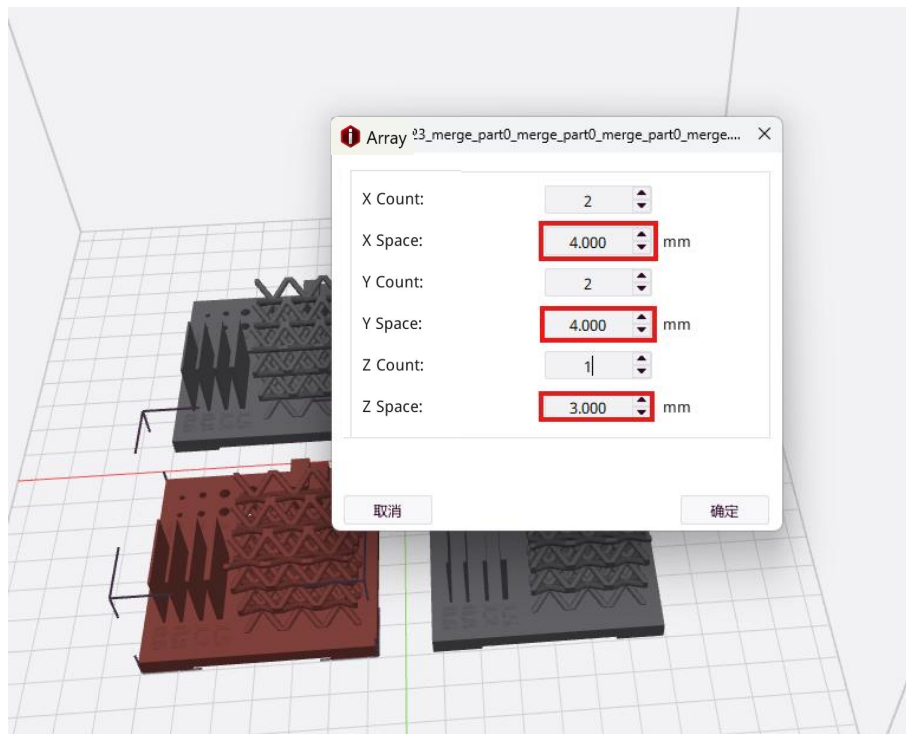


7. Build Nesting (Part Layout)

7.1 Nesting (Packing) Density

To prevent thermal cross-talk between neighbouring parts, which can cause shrinkage and distortion, maintain adequate spacing between parts in the build.

Direction	Clearance /mm	Remarks
X/Y	4	Prevents thermal interaction between parts
Z	3	Provides adequate vertical clearance to prevent thermal fusing between layers / parts.

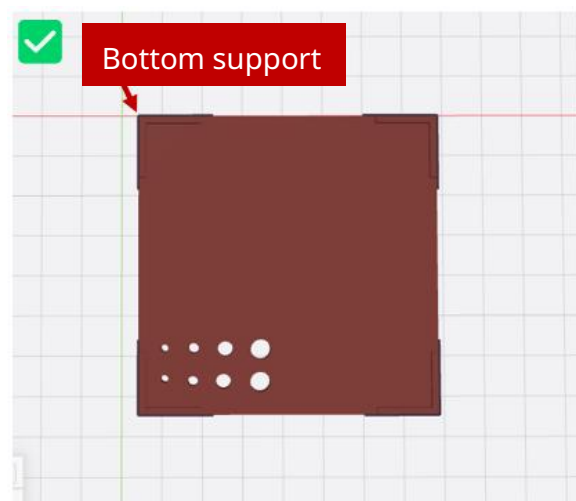
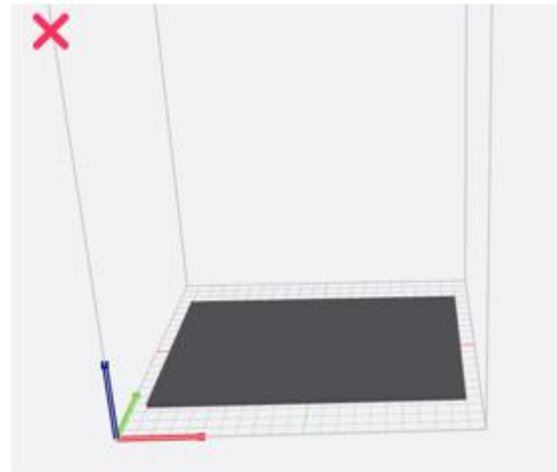
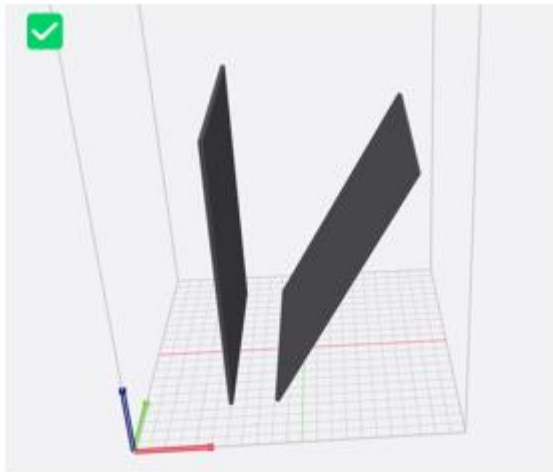


7.2 Large Flat Surfaces

Compared with PA12, TPU shrinks significantly during sintering and is prone to warping when large areas are built. Design recommendations:

- Orient large flat surfaces diagonally or vertically.
- For large flat plates, considerable distortion can occur on cooling and shrinkage; in such cases add sacrificial structures to counteract internal stresses.
- For distortion-sensitive large flat surfaces, prefer vertical or inclined orientation to ensure quality; for distortion-tolerant parts, prefer flat orientation to minimize build height.

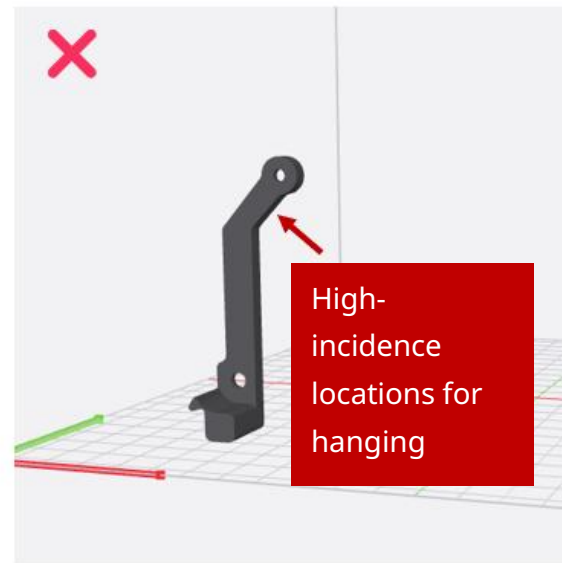
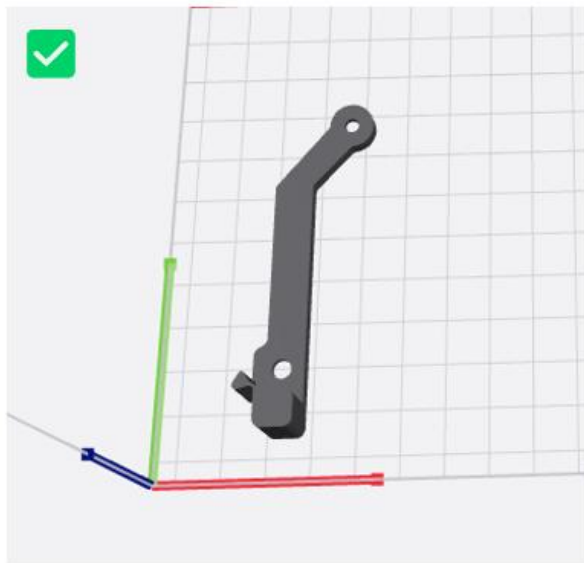




7.3 Overhangs

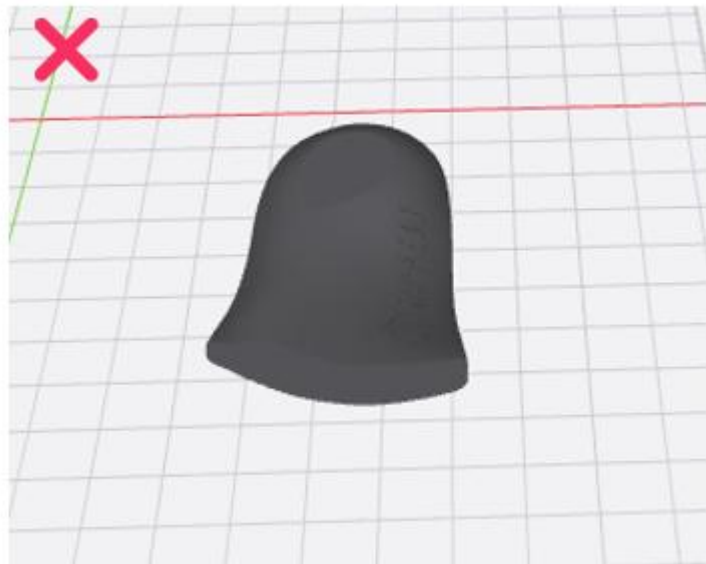
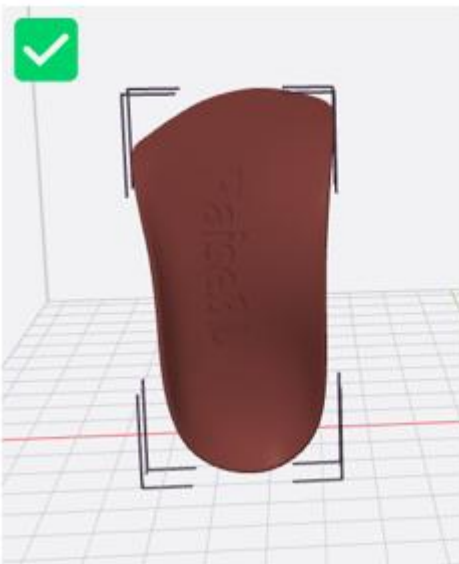
On thick-walled parts, TPU overhangs are prone to an orange-peel surface finish, especially on parts with small cross-sections; when nesting parts, avoid orienting them so that critical surfaces fall on overhangs.





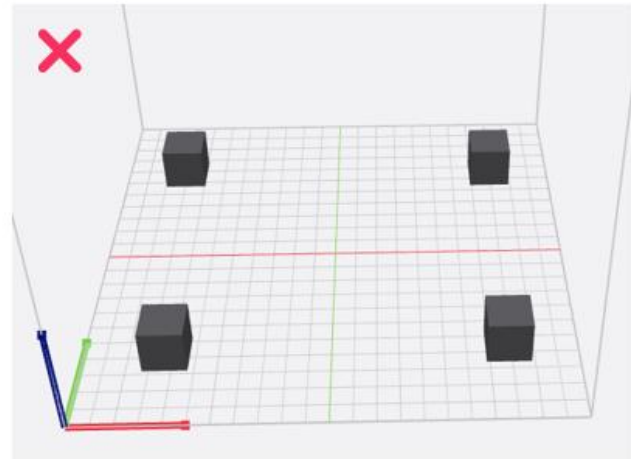
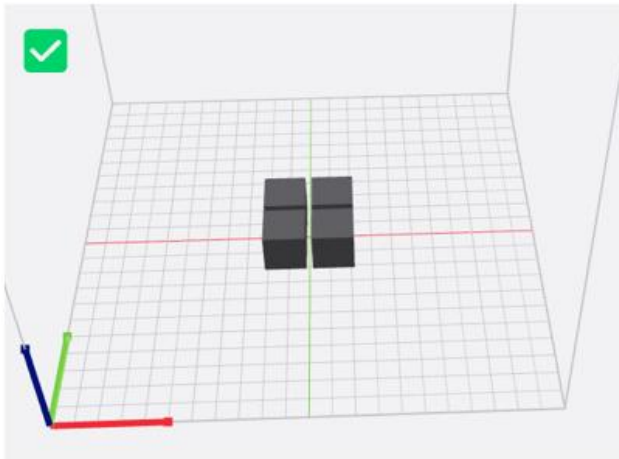
7.4 Fine / Detailed Features

During sintering, the down-facing (bottom) surface of TPU tends to slump slightly, blurring any features on it. Place fine features on side (vertical) surfaces and keep fine Z-direction features off the bottom face.



7.5 Small Parts

When nesting, place small parts (cross-sectional area $\leq 4 \text{ cm}^2$) as centrally as possible — small melt pools bond weakly to the powder bed, and edge placement can cause warping or part displacement (pushing).



7.6 Cycle-Time & Material Efficiency

For non-planar parts, orient the part flat on the build platform whenever possible to reduce build height, shortening both build time and material usage.

