

## DESIGN FOR SPEED

Following these design guidelines will result in an optimal and economical manufacturing time.

### FINISHES

- ▶ As machined finish, all sharp edges removed.
- ▶ Bead blast, fine matt finish (will be applied to whole component).
- ▶ Options to anodise or laser mark.

See more surface finishes and materials.

### HOLES

- ▶ No maximum, but some holes will be flat bottomed. Avoid deep drill holes.
- ▶ Minimum hole diameter 0.5 mm.

### SLOTS

- ▶ Maximise radii to allow for bigger diameter tools with deeper reach. Maximum slot depth 50 mm.
- ▶ Minimum slot width 0.75 mm. Using 1.25 mm will allow for greater depth and speed.

These features require side-setup. Designing for top/bottom access will minimise cost (mini cube).

### THREADS

- ▶ HELICOIL® – In metric and UN (in a range of common sizes).
- ▶ Counter bore – DfA and extend thread depth to more than  $\varnothing \times 2.5$ .
- ▶ Unified (inch) coarse and fine threads: General rule depth =  $\varnothing \times 2.5$ .
- ▶ Metric threads: M1.6 to M12. Selection of metric fine. General rule depth =  $\varnothing \times 2.5$ .

For our full range of threads, and dimensional lookup see [protolabs.co.uk/cncthreads](http://protolabs.co.uk/cncthreads)



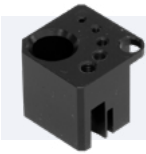
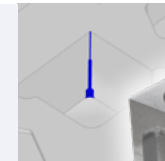
## DESIGN FOR FUNCTION

These features show off capabilities, but take longer to machine.

### CONTOURED SURFACES

- ▶ Ball milling provides 5-axis like contoured surfaces using 3-axis machining.
- ▶ Note the lofted radius – tool access from above.

Design for Manufacturability software will highlight sharp corners in blue (this material will not be machined)



A wide range of plastics are stocked.

### COMPLEX DETAILING

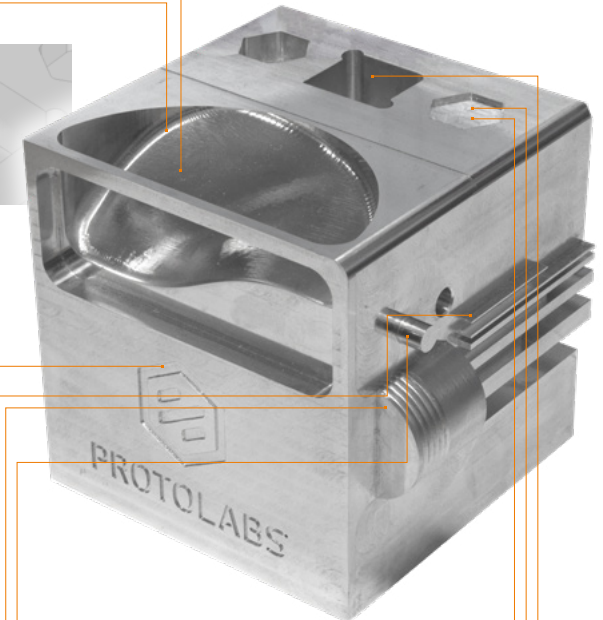
- ▶ Text is possible, but using smaller cutters takes longer. Using rounded text and adding radii will help.

### WALLS, BOSSES AND RAISED FEATURES

- ▶ A minimum wall thickness of 0.5 mm is possible. Keep material stiffness in mind – the thicker the better particularly for plastic/ductile materials.
- ▶ Try and avoid raised/embossed features (the whole of this face is removed to create it).
- ▶ Consider an insert (stud or dowel) as milling a hole or thread is more cost effective than a raised feature.

### POCKETS

- ▶ The smaller the radius, the smaller the tool, and so shallower the pocket.
- ▶ Either add a radius (and chamfer the insert).
- ▶ Or relieve (extend the cutter diameter beyond the corner) 2 options shown.



Cube sides are 90 mm, and manufactured in aluminium alloy 6082. For our full range of billet sizes see [protolabs.co.uk/CNCsize](http://protolabs.co.uk/CNCsize)

## FROM CAD TO COMPONENT... IN HOURS

1. We carefully check every Design for Manufacturability (DfM), and manufacturing time - typically in less than an hour.

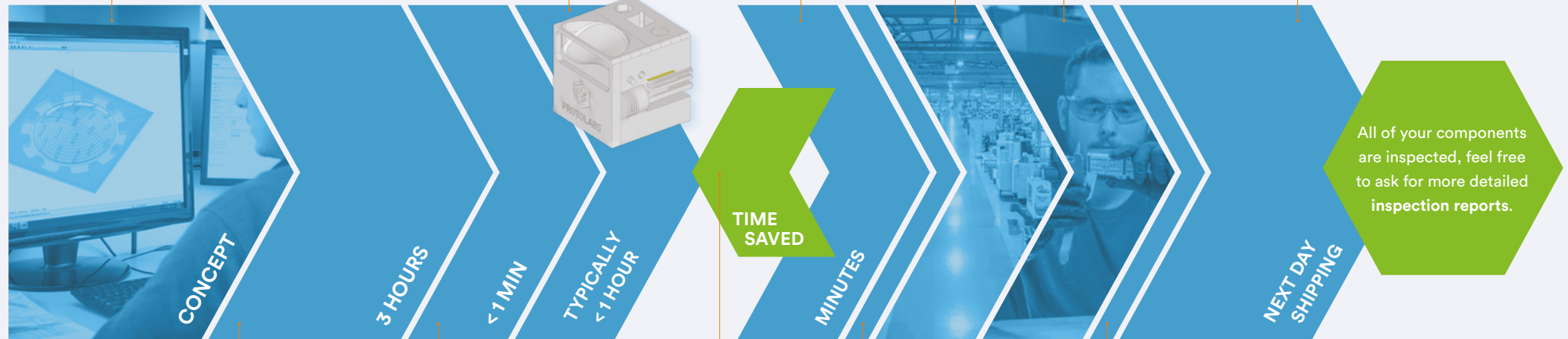
4. Digital manufacturing – for price and free DfM feedback. Feedback and **threads** are shown on your **3D design** – saving time on 2D drawings and calls (we have experts on call, if and when you need us).

6. Place order (PO or credit card).

8. Manufacturing. Our high-tech manufacturing facilities are purpose built for speed.

9. Inspection, measurement and gauging.

11. Shipping.



2. 3D CAD design time.

3. Upload for quote.

5. Accept the DfM advice or iterate design – ensuring right first time manufacturing and optimising DfM early.

7. Order stock = zero time, as we carry over 30 pre-prepared materials.

10. Securely packaged.

\*Expedite and shipping fees apply, our standard and typical manufacturing time is 3 working days + 1 day shipping. Times are applicable to this sample in aluminium, Bigger/more complex parts and different materials may take longer. Upload now for price and delivery time.



**36 HOURS\***  
**UPLOAD TO DELIVERY**