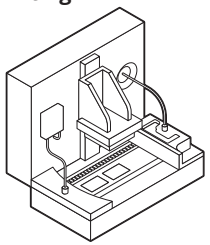
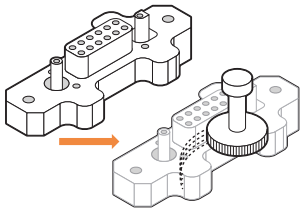
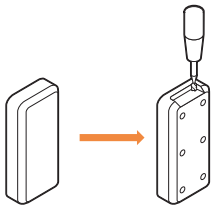
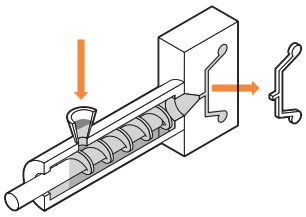
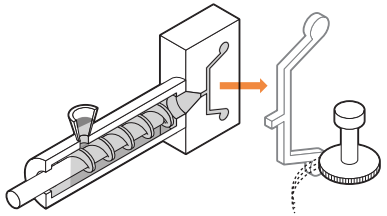
THE NEW APPROACH FOR YOUR PROTOTYPES AND SMALL SERIES

Processes at hand:	**3D printing**	**3D printing / machining**	**Preform / Green machining**	**Moulding**	**Moulding / machining / grinding**
					
Lead time in weeks	■■■■ 4 wks	■■■■■■ 6 wks	■■■ 3 wks	■■■■■■■■■ 8-10 wks	■■■■■■■■■■■■ 10-12 wks
Production quantity	1-1.000	1-1.000	1-100	100-10.000+	100-10.000+
Investment	•	•	•	•••	•••
Price level parts	•••	•••	•••	•	•
Complexity geometry	◆◆◆◆◆	◆◆◆◆◆	◆◆	◆◆◆◆	◆◆◆◆
Flexibility to redesign	◆◆◆◆◆	◆◆◆◆◆	◆◆◆	◆	◆◆
Size max. (box)	96x54x120 mm	96x54x120 mm	80x80x80 mm	60x60x60 mm	60x60x60 mm
Tolerances	± 0,5%	±0,3%	± 0,3%	± 0,3%	± 0,01 mm
Surface *	0,8-1,6 Ra	0,3-1,6 Ra	0,3-0,8 Ra	0,3-0,4 Ra	0,3-0,4 Ra

** The surface quality of all processes can be improved by a polishing process.*

Materials	ZrO_2 (white)	ZrO_2 (white)	ZrO_2 (colours)	ZrO_2 (colours)	ZrO_2 (colours)
	Al_2O_3	Al_2O_3	Al_2O_3	Al_2O_3	Al_2O_3
			ATZ	ATZ	ATZ
			Si_3N_4	Si_3N_4	Si_3N_4
				ESD ceramics	ESD ceramics
				Conductive ceramics	Conductive ceramics

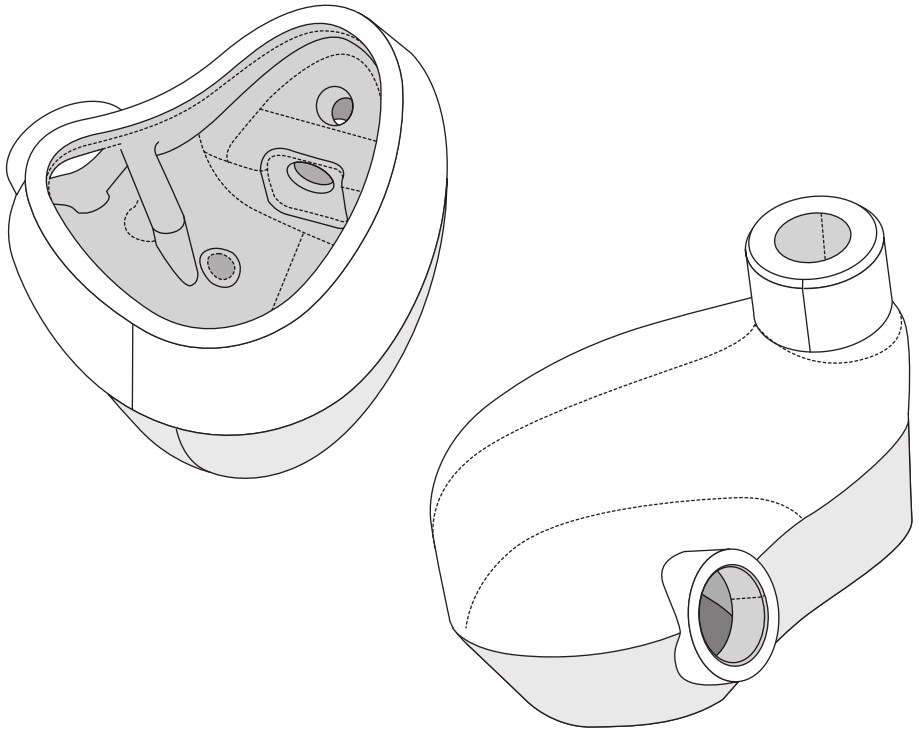
3D PRINTING

Lead time in weeks	■■■■ 4 wks
Production quantity	1-1.000
Investment	●
Price level parts	●●●
Complexity geometry	◆◆◆◆◆
Flexibility to redesign	◆◆◆◆◆
Size max. (box)	96x54x120 mm
Tolerances	± 0,5%
Surface	0,8-1,6 Ra
Materials	ZrO_2 (white) Al_2O_3

Housing for acoustic filters

Our 3D print Admaflex technology enables producing ceramic prototypes and small series without tooling, saving time and cost on tool manufacturing. It also provides the opportunity to print complex geometries, with the flexibility to make alterations as you go.

The demonstrated product is a high class acoustic in-ears e.g. for musicians. The combination of overall quantity, shape, aesthetics and acoustic requirements resulted in a perfect business case for 3D ceramic printing.

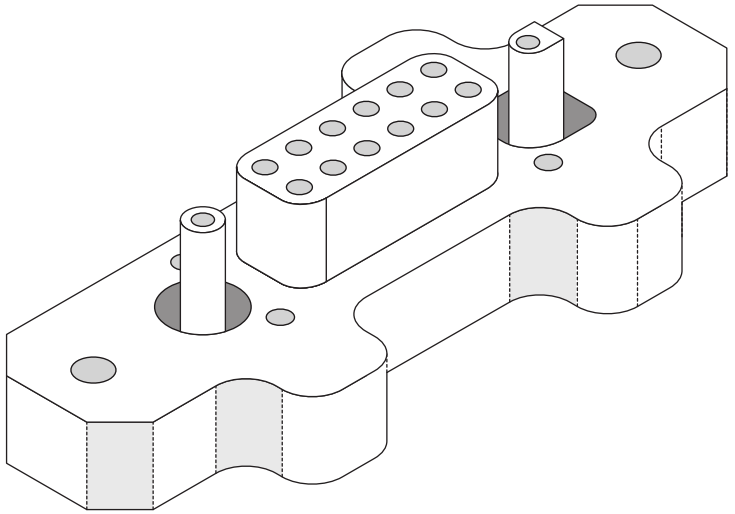


3D PRINTING / MACHINING

Lead time in weeks	■■■■■■ 6 wk
Production quantity	1-1.000
Investment	●
Price level parts	●●●
Complexity geometry	◆◆◆◆◆
Flexibility to redesign	◆◆◆◆◆
Size max. (box)	96x54x120 mm
Tolerances	± 0,3%
Surface	0,3-1,6 Ra
Materials	ZrO_2 (white) Al_2O_3

QC caliber

Formatec was challenged to make this part in low volume with high complexity and for some dimensions tight tolerances. A print plus machine approach was selected in order to deliver a total of ten products. The majority of the shape was a result of the printing process. The required dimensions for the twelve holes and two holes in the pillars were not achieved during printing and therefore post machined in the sintered phase. This approach helped to save money for the customer because expensive machining steps were only used to obtain the tight tolerances and not for shaping.

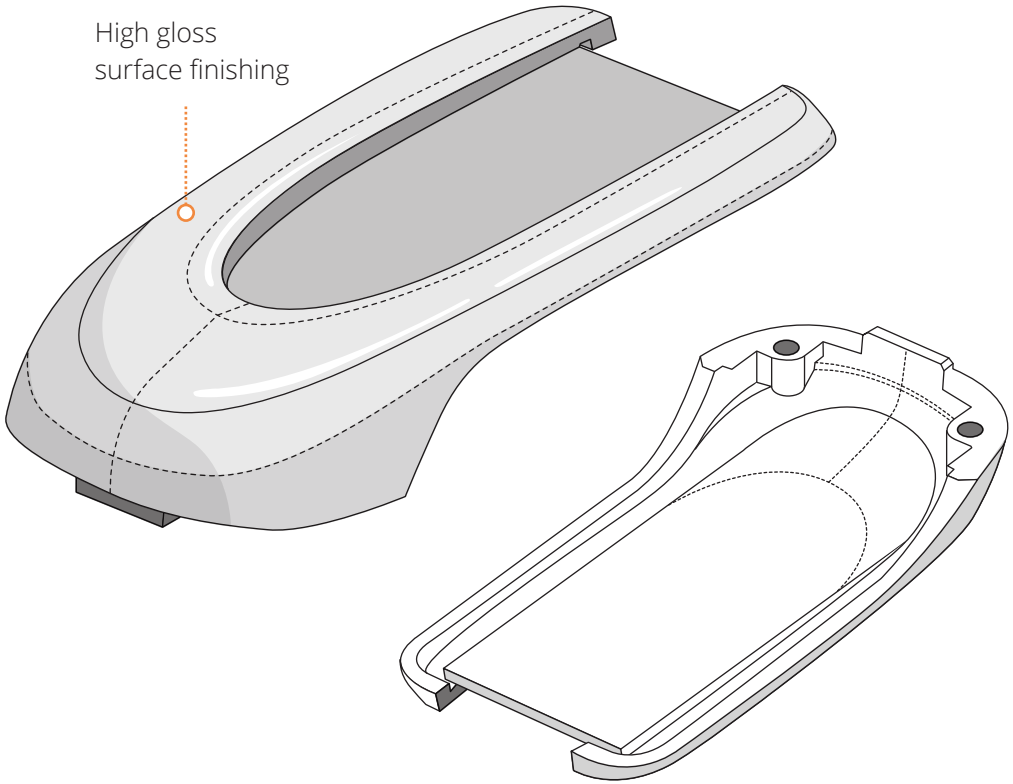


PREFORM / GREEN MACHINING

Lead time in weeks	■■■ 3 wk
Production quantity	1-100
Investment	●
Price level parts	●●●
Complexity geometry	◆◆
Flexibility to redesign	◆◆◆
Size max. (box)	80x80x80 mm
Tolerances	± 0,3%
Surface	0,3-0,8 Ra
Materials	ZrO_2 (colours) Al_2O_3 ATZ Si_3N_4

Key fob

This part was produced through green machining, because of the size which is not ideal for 3D printing. A preform was produced with a simple mould, in the end to create a near nett shape. By applying our in-house developed process FormShape; 5-ax milling with special coated tools, debinding and sintering. In the end, the product as been delivered in a high gloss surface finishing, which was very well received by the customer.



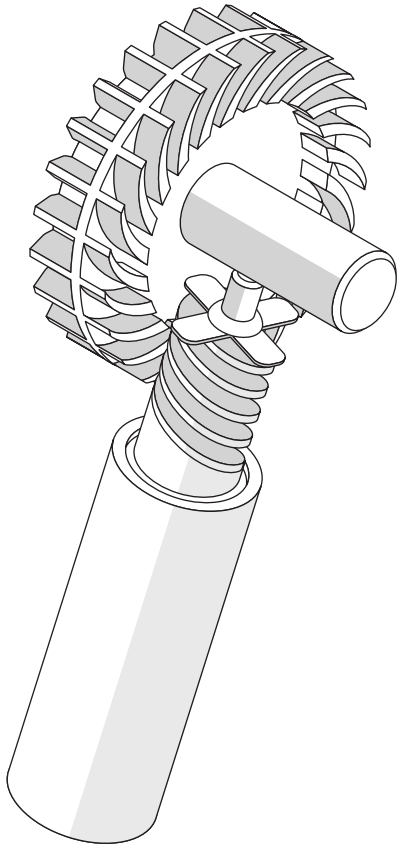
MOULDING

Lead time in weeks	8-10 wks
Production quantity	100-10.000+
Investment	●●●
Price level parts	●
Complexity geometry	◆◆◆◆
Flexibility to redesign	◆
Size max. (box)	60x60x60 mm
Tolerances	± 0,3%
Surface	0,3-0,4 Ra
Materials	ZrO_2 (colours) Al_2O_3 ATZ Si_3N_4 ESD ceramics Conductive ceramics

Driving & Crown gear

Ceramic Injection Moulding (CIM) can be compared to the reproducibility of plastic injection moudling, delivering quality for an economical price.

The gear set was produced by moulding, debinding, sintering and tumble finishing. Tolerances kept throughout this process on this geometry are +/- 0.01mm or smaller.



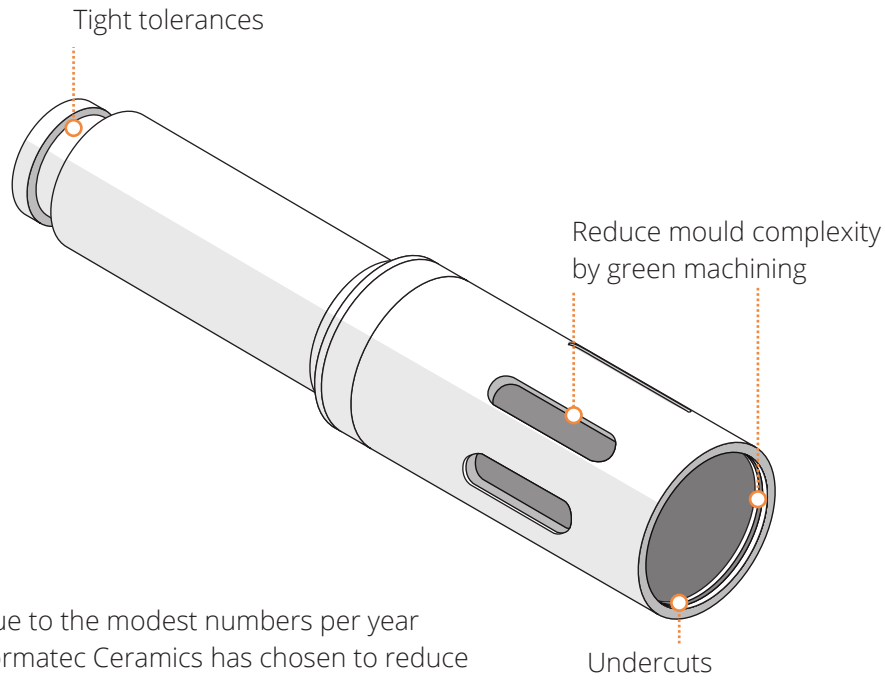
MOULDING / MACHINING / GRINDING

Lead time in weeks	■■■■■■■■■■■■ 10-12 wks
Production quantity	100-10.000+
Investment	●●
Price level parts	●
Complexity geometry	◆◆◆◆
Flexibility to redesign	◆◆
Size max. (box)	60x60x60 mm
Tolerances	± 0,01mm
Surface	0,3-0,4 Ra
Materials	ZrO_2 (colours) Al_2O_3 ATZ Si_3N_4 ESD ceramics Conductive ceramics

Sensor housing

Ceramic Injection Moulding (CIM) can be compared to the reproducibility of plastic injection moudling, delivering quality for an economical price.

For some parts we use the moulded geometry as starting point. After that, we can add machining steps for various reasons. Examples of these are shown in the drawing below;



Due to the modest numbers per year Formatec Ceramics has chosen to reduce the mould complexity by green machine the slots and undercuts. A final dimensions is tightly toleranced and will be grinded.