

# ULTEM 1010 Resin



## FDM Thermoplastic Filament

The information presented are typical values intended for reference and comparison purposes only. They should not be used for design specifications or quality control purposes.



## Overview

ULTEM™ 1010 resin is a high-performance FDM® polyetherimide (PEI) thermoplastic. It exhibits high tensile strength in addition to broad chemical resistance and excellent thermal stability. Its high heat resistance makes it autoclave-capable for applications involving sterilization and composite lay-up tooling.

This material is available in both general-purpose and certified grades (CG). ULTEM 1010 resin is used with breakaway support material and is available in natural color.

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## Ordering Information

**Table 1. Printer and Support Material Compatibility**

Printer	Model Tip (Slice)	Support Material	Support Tip
Fortus 400mc™	T14 (10 slice)	1010 support (breakaway)	T16 (10, 13 slice)
	T20 (13 slice)		
Fortus 450mc™	T14 (10 slice)	1010 support (breakaway)	T16 (10, 13 slice)
	T20 (13 slice)		
Fortus 900mc™/F900™	T14 (10 slice)	1010 support (breakaway)	T16 (10, 13 slice)
	T20 (13 slice)		
	T40A (20 slice)		T20 (20 slice)

### Build Sheet

High Temperature

- 0.02 x 26 x 38 in.
- 0.02 x 16 x 18.5 in.

**Table 2. ULTEM™ 1010 Resin Ordering Information**

Part Number	Description
<b>Filament Canisters<sup>1 2</sup></b>	
355-02330	ULTEM™ 1010 resin, 92.3 cu in - Plus
355-02320	ULTEM™ 1010 resin CG, 92.3 cu in - Plus
312-22100	ULTEM™ 1010 resin, 92.3 cu in - Classic
312-22000	ULTEM™ 1010 resin CG, 92.3 cu in - Classic
355-03240	ULTEM Support, 92.3 cu in. - Plus
310-31000	ULTEM Support, 92.3 cu in. - Classic
<b>Printer Consumables</b>	
511-12000	T14 tip
511-10701	T20 tip
511-10750	T40A tip
511-10401	T16 tip
325-00275-S	High Temperature build sheet, 0.02x26x38 in. (0.51x660x965 mm)
325-00475-S	High Temperature build sheet, 0.02x16x18.5 in. (0.51x406x470 mm)
310-00300	High Temperature build sheet, 0.03x16x18.5 in. (0.76x406x470 mm)

<sup>1</sup> Classic canisters are compatible with Fortus 900mc printers prior to s/n L502.

<sup>2</sup> Plus canisters are compatible with all Fortus 450mc, all Stratasys F900, and Fortus 900mc printers s/n L502 and up.

## Physical Properties

Values are measured as printed. XY, XZ, and ZX orientations were tested. For full details refer to the [Stratasys Materials Test Report](#) (immediate download upon clicking the link). DSC and TMA curves can be found in the Appendix.

**Table 3. ULTEM™ 1010 Resin Physical Properties**

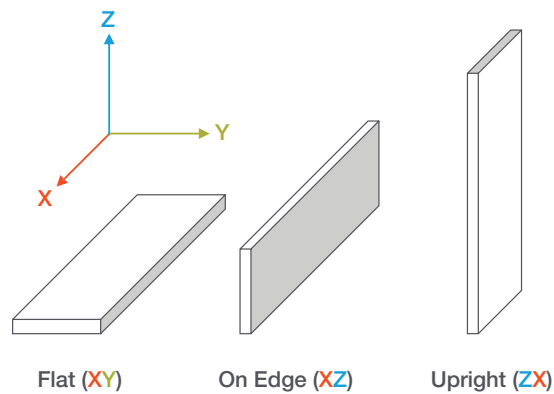
Property	Test Method	Typical Values	
		XY	XZ/ZX
HDT @ 66 psi	ASTM D648 Method B	214.1 C (417.3 F)	
HDT @ 264 psi	ASTM D648 Method B	212.2 C (413.9 F)	
Tg	ASTM D7426 Inflection Point	209.37 C (408.87 F)	
Mean CTE	ASTM E831 (-50 °C to 60 °C)	36.08 $\mu\text{m}/[\text{m}^{\circ}\text{C}]$ (20.04 $\mu\text{in}/[\text{in}^{\circ}\text{F}]$ )	-
	ASTM E831 (60 °C to 205 °C)	29.81 $\mu\text{m}/[\text{m}^{\circ}\text{C}]$ (16.56 $\mu\text{in}/[\text{in}^{\circ}\text{F}]$ )	-
	ASTM E831 (-50 °C to 110 °C)	-	32.50 $\mu\text{m}/[\text{m}^{\circ}\text{C}]$ (18.06 $\mu\text{in}/[\text{in}^{\circ}\text{F}]$ )
	ASTM E831 (110 °C to 165 °C)	-	16.19 $\mu\text{m}/[\text{m}^{\circ}\text{C}]$ (8.995 $\mu\text{in}/[\text{in}^{\circ}\text{F}]$ )
Volume Resistivity	ASTM E831 (165 °C to 200 °C)	-	4.291 $\mu\text{m}/[\text{m}^{\circ}\text{C}]$ (2.384 $\mu\text{in}/[\text{in}^{\circ}\text{F}]$ )
	ASTM D257	>7.00*10 <sup>14</sup> $\Omega\cdot\text{cm}$	
Dielectric Constant	ASTM D150 1 kHz test condition	2.865	
	ASTM D150 2 MHz test condition	3.123	
Dissipation Factor	ASTM D150 1 kHz test condition	-0.002	
	ASTM D150 2 MHz test condition	0.000	
Specific Gravity	ASTM D257 @23 °C	1.29	

## Mechanical Properties

ULTEM 1010 resin samples were printed with a 0.010 in. (0.254 mm) layer height on the F900. For the full test procedure please see the [Stratasys Materials Test Procedure](#) (immediate download upon clicking the link).

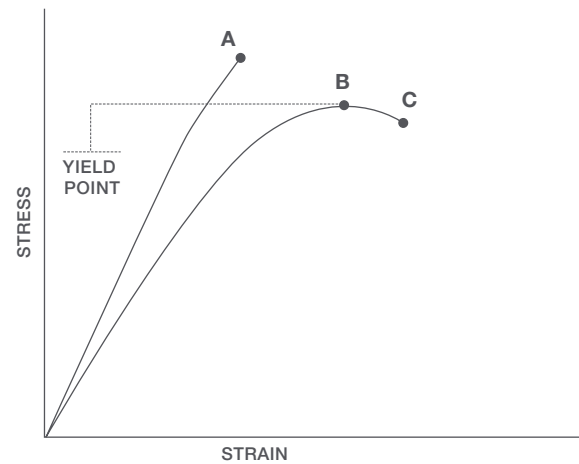
### Print Orientation

Parts created using FDM are anisotropic as a result of the printing process. Below is a reference of the different orientations used to characterize the material.



### Tensile Curves

Due to the anisotropic nature of FDM, tensile curves look different depending on orientation. Below is a guide of the two types of curves seen when printing tensile samples and what reported values mean.



- A** = Tensile at break, elongation at break (no yield point)
- B** = Tensile at yield, elongation at yield
- C** = Tensile at break, elongation at break

**Table 4. ULTEM™ 1010 Resin Mechanical Properties (Fortus 900mc - T14 Tip)**

		XZ Orientation <sup>1</sup>	ZX Orientation <sup>1</sup>
<b>Tensile Properties: ASTM D638</b>			
Yield Strength	MPa	No yield	No yield
	psi		
Elongation @ Yield	%	No yield	No yield
Strength @ Break	MPa	79.2 (4.9)	28.2 (8.8)
	psi	11500 (710)	4080 (1300)
Elongation @ Break	%	4.0 (0.42)	1.1 (0.45)
Modulus (Elastic)	GPa	3.04 (0.18)	3.00 (0.45)
	ksi	441 (27)	435 (65)
<b>Flexural Properties: ASTM D790, Procedure A</b>			
Strength @ Break	MPa	No break	81.6 (13)
	psi	No break	11800 (1900)
Strength @ 5% Strain	MPa	128 (1.8)	-
	psi	18600 (270)	-
Strain @ Break	%	No break	3.19 (0.53)
Modulus	MPa	2.91 (0.049)	2.64 (0.13)
	ksi	422 (7.0)	383 (19)
<b>Compression Properties: ASTM D695</b>			
Yield Strength	MPa	245 (50)	438 (31)
	psi	35600 (7200)	63500 (4500)
Modulus	GPa	2.93 (0.14)	3.23 (0.57)
	ksi	425 (20)	468 (83)
<b>Impact Properties: ASTM D256, ASTM D4812</b>			
Notched	J/m	26.6 (3.5)	21.7 (4.7)
	ft*lb/in.	0.498 (0.065)	0.407 (0.089)
Unnotched	J/m	260 (57)	68.0 (29.8)
	ft*lb/in.	4.87 (1.1)	1.27 (0.56)

<sup>1</sup> Values in parentheses are standard deviations.

## Outgassing

ULTEM™ 1010 resin, natural, was printed with a T14 tip on a Stratasys Fortus 450mc and tested per ASTM E595-15. Full report available upon request.

**Table 5. ULTEM™ 1010 Resin Outgassing Test Results**

Sample	TML (%)	CVCM (%)	WVR (%)
ULTEM™ 1010 Resin, Natural, T14 tip, Flat (XY)	0.55	0.02	0.39
ULTEM™ 1010 Resin, Natural, T14 tip, Upright (ZX)	0.58	0.03	0.33
<b>Testing Observations<sup>(1)</sup></b>			
Visible Condensate	No	Opaque	N/A
Percent Covered	0%	Interference Fringes	N/A
Thin	N/A	Colored Fringes	N/A
Heavy	N/A	Sample appearance after test	No change
Transparent	N/A		

(1) Observations apply to all tested samples

## Appendix

Figure 1. 2nd heating scan DSC data for the ULTEM™ 1010 resin Flat (XY) sample.

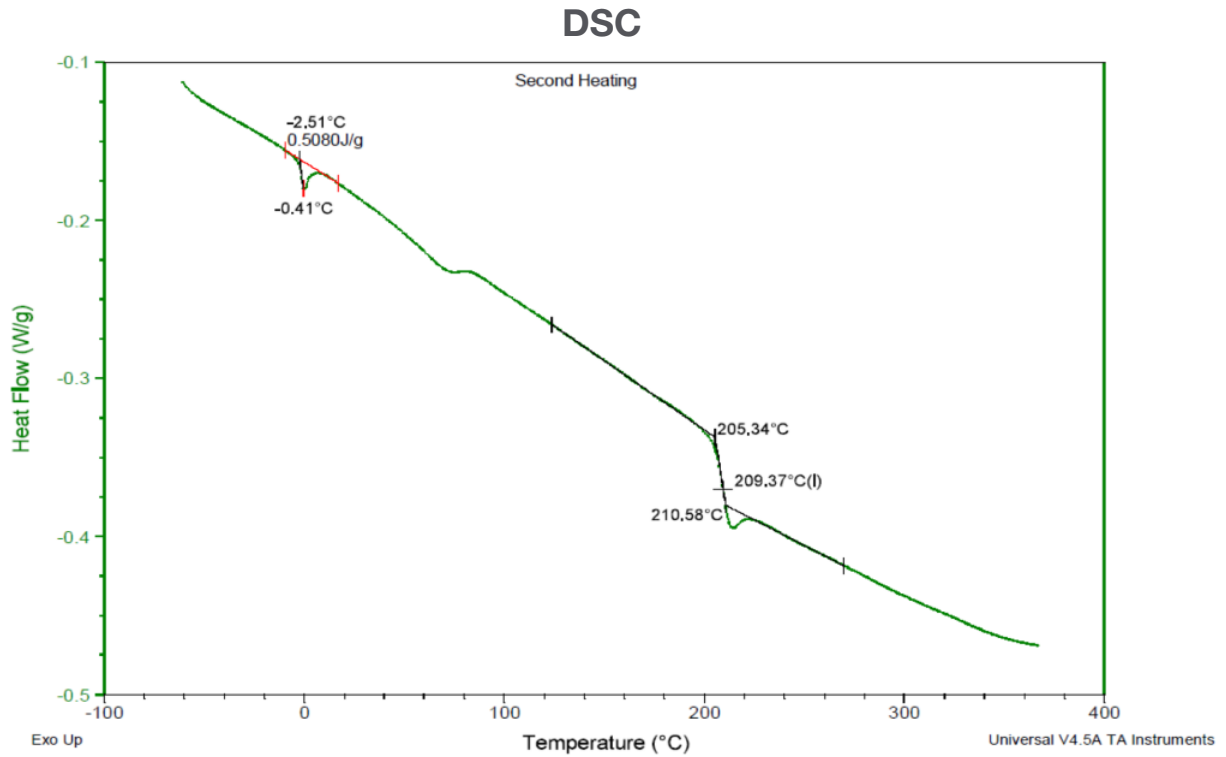




Figure 2. – Dimension change data as a function of temperature for the ULTEM™ 1010 resin Flat (XY) sample.

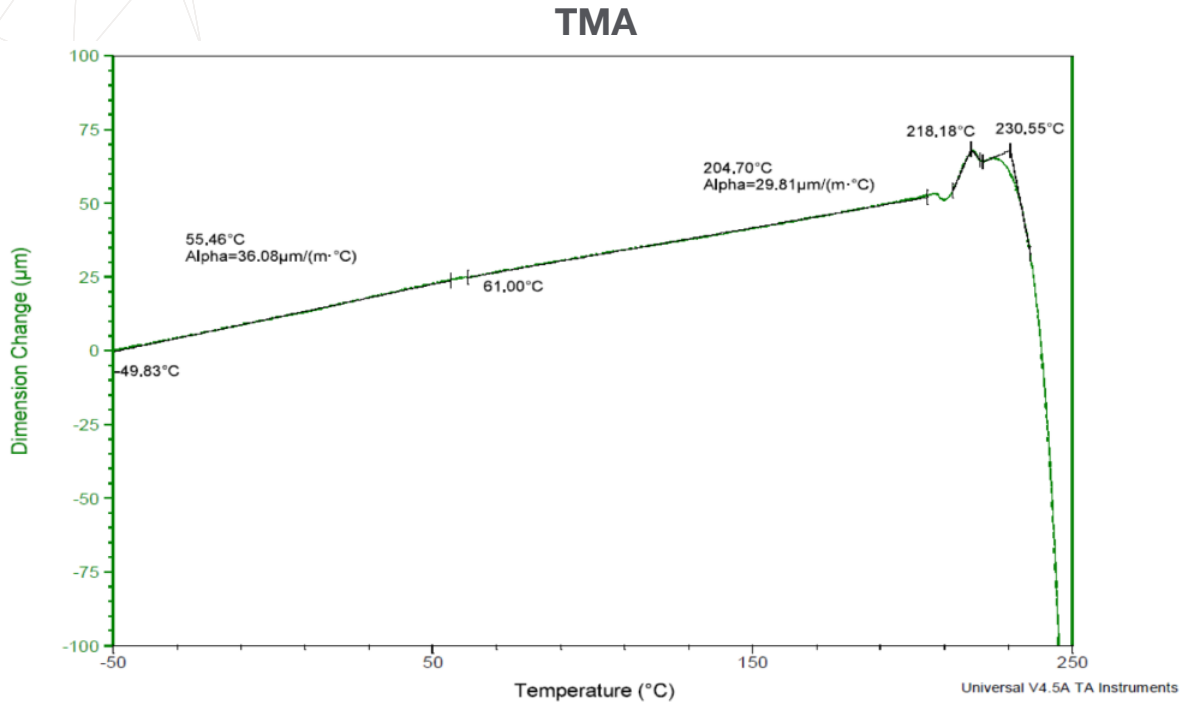


Figure 3. Dimension change data as a function of temperature for the ULTEM™ 1010 resin On Edge (XZ) sample.

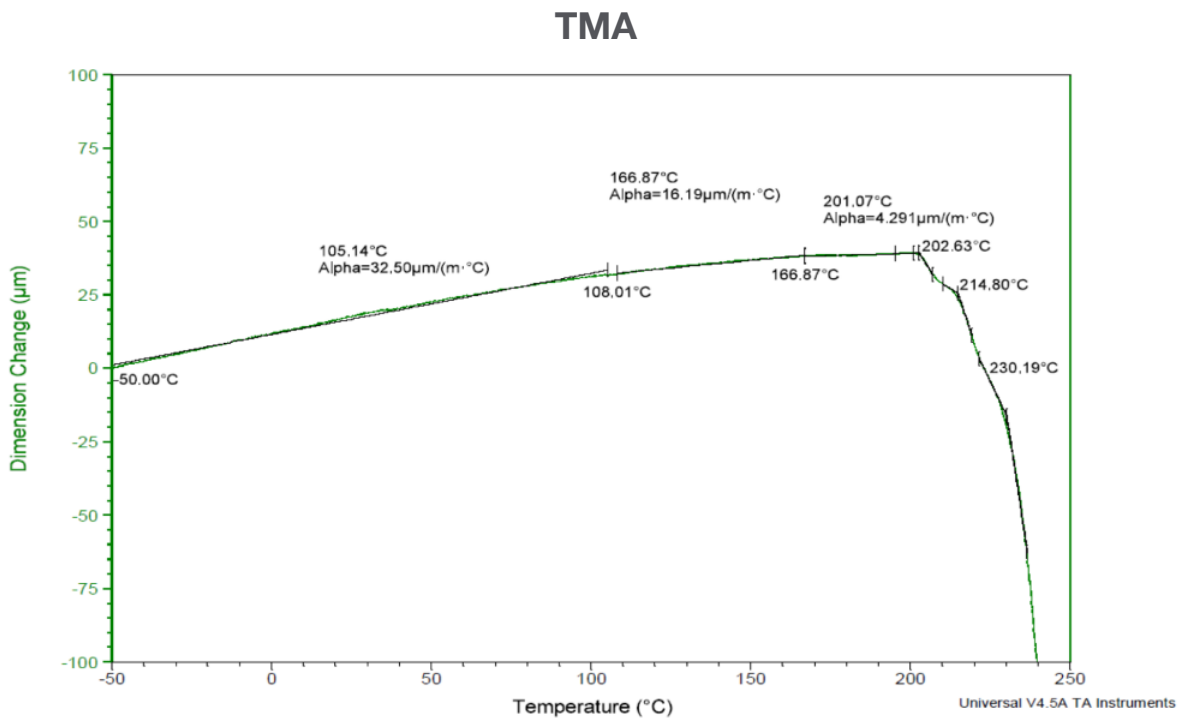
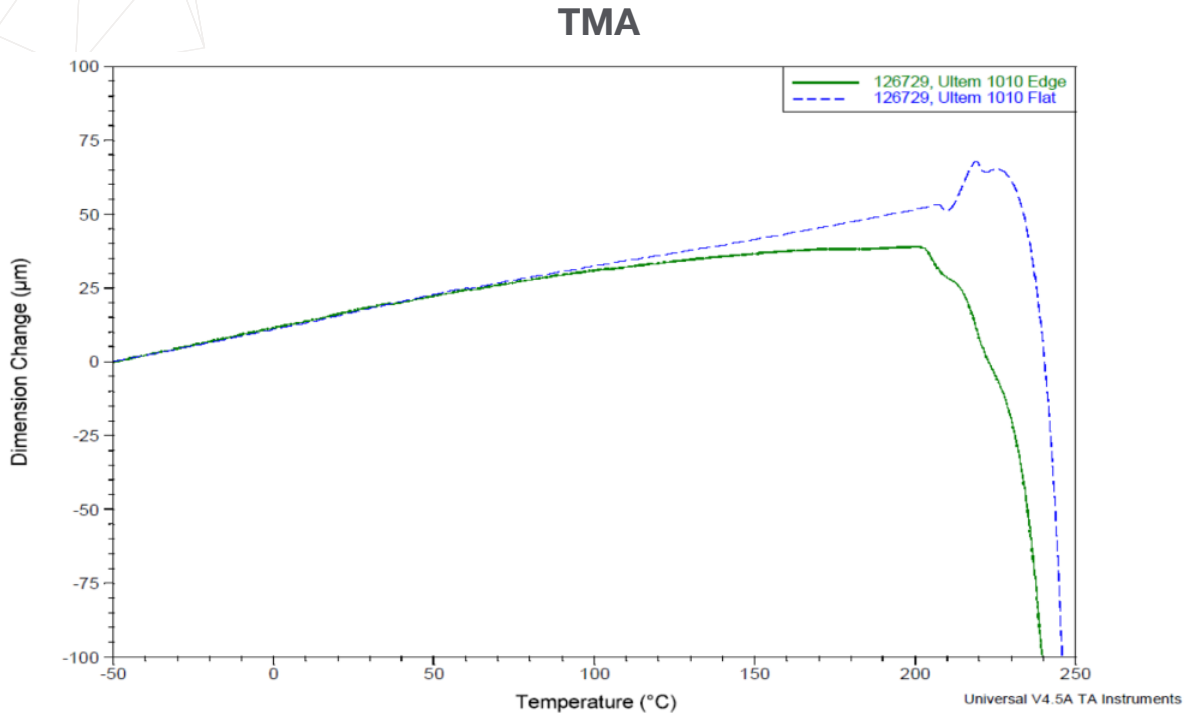


Figure 4. – Overlay of the dimension change data for the Flat (XY) and On Edge (XZ) ULTEM™ 1010 resin samples.



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