Ultimaker

# Ultimaker PETG
Technical data sheet

## General overview

| | |
|---|---|
| **Chemical composition** | See PETG safety data sheet, section 3 |
| **Description** | Ultimaker PETG key has good all-round properties, making it an ideal starting material for anyone requiring more heat and chemical resistance than PLA |
| **Key features** | Ultimaker PETG material is an affordable all-round material that is easy to use. It prints just as easy as PLA, and can be used with Ultimaker support materials (PVA and Breakaway). In contrast to PLA, it is less brittle and offers additional resistance additional resistance to alcohols and weak acids/bases, as well as additional heat resistance up to 76 °C. |
| **Applications** | Visual prototyping, Functional prototyping, Short-run manufacturing, Custom components, Fit testing, Tooling, Custom connectors or packages for liquids |
| **Non-suitable for** | Food contact and in vivo applications. Applications where the printed part is exposed to temperatures higher than 76 °C |

## Filament specifications

| | Method (standard) | Value |
|---|---|---|
| **Diameter** | – | 2.85 ± 0.05 mm |
| **Max roundness deviation** | – | 0.05 mm |
| **Net filament weight** | – | 750g |
| **Filament length** | – | ~ 93 m |

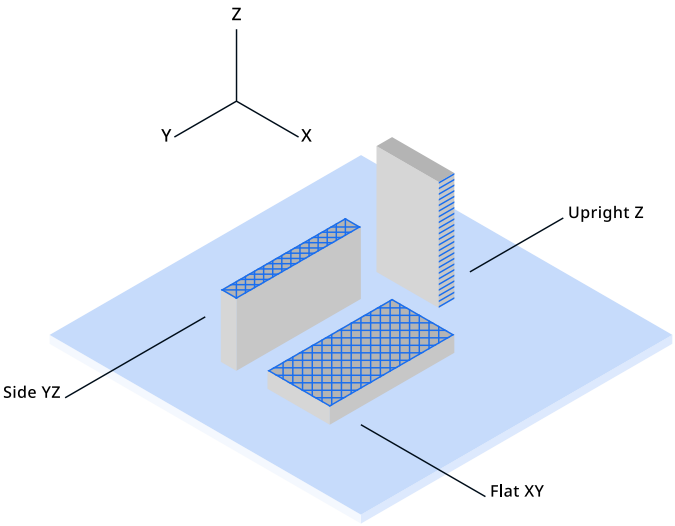
## Color information

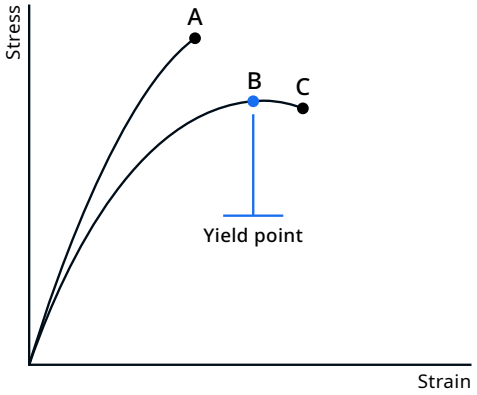
| Color | Color code |
|---|---|
| Black | RAL 9017 |
| White | RAL 9003 |
| Silver | RAL 9006 |
| Grey | RAL 7012 |
| Transparant | N/A |
| Blue | RAL 5005 |
| Blue Translucent | Pantone 286 C |
| Red | RAL 3020 |
| Red Translucent | Pantone 7622 C |
| Green | RAL 6024 |
| Green Translucent | Pantone 3425 C |
| Yellow | RAL 1016 |
| Yellow Fluorescent | Pantone 3570 C |
| Orange | Pantone 1655 C |

# Mechanical properties

All samples were 3D printed. See ‘Notes’ section for details.

| | Test method | Typical value | | |
|---|---|---|---|---|
| | | XY (Flat) | YZ (Side) | Z (Up) |
| **Tensile (Young’s) modulus** | ASTM D3039 (1 mm / min) | 1939 ± 28 MPa | 1874 ± 31 MPa | 1711 ± 45 MPa |
| **Tensile stress at yield** | ASTM D3039 (5 mm / min) | 46.2 ± 0.8 MPa | 50.3 ± 1.0 MPa | – |
| **Tensile stress at break** | ASTM D3039 (5 mm / min) | 38.5 ± 1.4 MPa | 44.0 ± 3.7 MPa | 19.0 ± 6.4 MPa |
| **Elongation at yield** | ASTM D3039 (5 mm / min) | 5.9 ± 0.1% | 6.0 ± 0.2% | – |
| **Elongation at break** | ASTM D3039 (5 mm / min) | 7.6 ± 0.2% | 6.4 ± 0.6% | 1.8 ± 0.8% |
| **Flexural modulus** | ISO 178 (1 mm / min) | 1882 ± 30 MPa | 1681 ± 61 MPa | 1489 ± 25 MPa |
| **Flexural strength** | ISO 178 (5 mm / min) | 78.9 ± 1.0 MPa at 5.5% strain | 75.8 ± 2.0 MPa at 5.5% strain | 50 ± 3.5 MPa at 3.6% strain |
| **Flexural strain at break** | ISO 178 (5 mm / min) | No break (>10%) | No break (>10%) | 3.6 ± 0.4% |
| **Charpy impact strength (at 23 °C)** | ISO 179-1 / 1eB (notched) | 7.9 ± 0.6 kJ/m² | | |
| **Hardness** | ISO 7619-1 (Durometer, Shore D) | 76 Shore D | | |




A. Tensile stress at break, elongation at break (no yield point)
B. Tensile stress at yield, elongation at yield
C. Tensile stress at break, elongation at break

## Print orientation

As the FFF process produces part in a layered structure, mechanical properties of the part vary depending on orientation of the part. In-plane there are differences between walls (following the contours of the part) and infill (layer of 45° lines). These differences can be seen in the the data for XY (printed flat on the build plate - mostly infill) and YZ (printed on its side - mostly walls). Additionally, the upright samples (Z direction) give information on the strength of the interlayer adhesion of the material. Typically the interlayer strength (Z) has the lowest strength in FFF.

Note: All samples are printed with 100% infill - blue lines in the ilustration indicate typical directionality of infill and walls in a printed part.

## Tensile properties

Printed parts can yield before they break, where the material is deforming (necking) before it breaks completely. When this is the case, both the yield and break points will be reported. Typical materials that yield before breaking are materials with high toughness like Tough PLA, Nylon and CPE+.

If the material simply breaks without yielding, only the break point will be reported. This is the case for brittle materials like PLA and PC Transparant, as well as elastomers (like TPU).

# Thermal properties

Samples marked with an asterisk (*) were 3D printed. See ‘Notes’ section for details.

| | Test Method | Typical value |
|---|---|---|
| **Melt mass-flow rate (MFR)** | ISO 1133 (190 °C, 2.16 kg) | 6.4 g / 10 min |
| **Heat deflection (HDT) at 0.455 MPa*** | ISO 75-2 / B | 76.2 ± 0.8 °C |
| **Vicat softening temperature*** | ISO 306 / A120 | 82.9 ± 0.4 °C |
| **Glass transition** | ISO 11357 (DSC, 10 °C / min) | 77.4 °C |
| **Melting temperature** | ISO 11357 (DSC, 10 °C / min) | - (amorphous) |

# Other properties

| | | |
|---|---|---|
| **Specific gravity** | ISO 1183 | 1.27 g / $cm^3$ |

# Notes

*3D Printing: all samples were printed using a new spool of material loaded in an Ultimaker S5 Pro bundle with engineering intent profiles using 0.15 mm layer height with AA0.4 printcore and 100% infill, using Ultimaker Cura 4.9. Samples were printed ‘one-at-a-time’. Printed samples were conditioned in room temperature for at least 24h before measuring.

Specimen dimensions (L x W x H):
- Tensile test: 215 x 20 x 4 mm
- Flexural/Vicat/HDT: 80 x 10 x 4 mm
- Charpy: 80 x 10 x 4 mm with printed Notch (Type 1eB)

# Disclaimer

Any technical information or assistance provided herein is given and accepted at your risk, and neither Ultimaker nor its affiliates make any warranty relating to it or because of it. Neither Ultimaker nor its affiliates shall be responsible for the use of this information, or of any product, method or apparatus mentioned, and you must make your own determination of its suitability and completeness for your own use, for the protection of the environment, and for the health and safety of your employees and purchasers of your products. No warranty is made of the merchantability or fitness of any product; and nothing herein waives any of Ultimaker’s conditions of sale. Specifications are subject to change without notice.

| | |
|---|---|
| Version | v1.00 |
| Date | April 29, 2022 |