PC-ABS-FR 3D Printing Filament

Technical Data Sheet

Version: 3.0 **Issue Date:** 2026-03-03 **Status:** Released

1. Product Identification

Product Name	PC-ABS-FR 3D Printing Filament
Material Type	Flame-Retardant Polycarbonate / ABS Blend (PC-ABS-FR)
Chemical Family	Amorphous Engineering Thermoplastic Alloy with Flame-Retardant Additives
Composition	Polycarbonate (PC) + Acrylonitrile Butadiene Styrene (ABS) + Flame-Retardant Package
Flame Retardancy Rating	UL94 V-0 @ 1.5 mm (Typical)
Brand	SSSray

Product Introduction

PC-ABS-FR 3D Printing Filament is a flame-retardant engineering blend that combines the heat resistance and toughness of polycarbonate (PC), the processability of acrylonitrile butadiene styrene (ABS), and a self-extinguishing additive package that meets UL94 V-0 requirements. The result is a strong, dimensionally stable, ignition-resistant material suited to functional prototypes and end-use parts that must survive demanding mechanical, thermal, and electrical service conditions.

Engineered for FFF (Fused Filament Fabrication) additive manufacturing, this filament provides high impact strength, good chemical resistance, and stable mechanical performance up to 100°C continuous service. Compared with standard PC-ABS, the FR additive package slightly increases density and reduces elongation, while still preserving the high notched impact characteristic of polycarbonate. Compared with PETG-FR, PC-ABS-FR delivers significantly higher heat resistance and impact performance, positioning it as the engineering-grade solution for ignition-risk applications.

PC-ABS-FR is intended for professional users who need true engineering performance combined with flame retardancy from a desktop 3D printing workflow. A heated print chamber, an all-metal hot end, a hardened steel nozzle, and thorough filament drying are mandatory to fully exploit the material's capabilities. The filament is well suited for electrical enclosures, automotive interior prototypes, industrial equipment housings, rail and transit interior parts, and any application where a part must pass stringent mechanical, thermal, and flammability requirements.

2. Core Features

UL94 V-0 Flame Retardancy

Self-extinguishing formulation achieves UL94 V-0 rating at 1.5 mm thickness with low smoke emission.

High Impact & Toughness

Polycarbonate contribution delivers engineering-grade impact strength well above commodity FR filaments.

Excellent Heat Resistance

Heat deflection temperature up to 103°C at 0.455 MPa for parts exposed to elevated service temperatures.

Engineering-Grade Strength

High tensile and flexural strength with balanced rigidity for load-bearing functional parts and assemblies.

Improved Printability vs. PC

Lower processing temperature and reduced warping compared with pure PC, while retaining engineering performance.

Good Chemical Resistance

Resists many industrial chemicals, oils, greases, and cleaning agents commonly encountered in service environments.

Typical Application Scenarios

- ✓ Electrical enclosures, junction boxes, and cable management parts
- ✓ Industrial equipment housings, covers, and control panels
- ✓ Power tool prototypes and ruggedized enclosures
- ✓ Server-room brackets, mounts, and data-center accessories
- ✓ Safety equipment housings and impact-resistant parts
- ✓ Automotive interior prototype components and trim
- ✓ Rail, transit, and vehicle interior prototype parts
- ✓ Heavy-duty mechanical assemblies and structural components
- ✓ Aerospace prototyping and ground-support equipment
- ✓ Engineering functional test parts for qualification trials

3. Printing Parameters

Parameter	Recommended Range	Optimal Value
Nozzle Temperature	250°C - 280°C	**265°C**
Hot Bed Temperature	90°C - 110°C	**100°C**
Print Speed	40 - 300 mm/s	
First Layer Speed	20 - 30 mm/s	
Layer Fan Speed	0 - 30% (Recommended: Off for the first 3 - 4 layers, then 0-30% to maintain layer bonding)	
Chamber Temperature	70°C - 90°C (heated chamber strongly recommended for large or dimensionally critical parts)	
Nozzle Material	Hardened steel nozzle required (≥0.4 mm); FR additives are abrasive and an all-metal hot end is required for 250°C+ operation	

Retraction Settings	Distance: 2 - 4 mm | Speed: 30 - 50 mm/s
Drying Conditions	80°C for 6 - 8 hours (mandatory if moisture is suspected; PC component is hygroscopic)

Note: *PC-ABS-FR combines the printability challenges of PC, ABS, and flame-retardant systems. A heated print chamber, an all-metal hot end capable of 250°C+, a hardened steel nozzle, and thorough filament drying are essential for reliable results. Always perform calibration prints when changing materials or making significant parameter adjustments, and ensure filament is thoroughly dried before each printing session.*

4. Physical Properties

4.1 Physical Properties

Property	Typical Value	Test Standard	Unit
Net Weight	1	-	kg
Density	1.20	ISO 1183 / ASTM D792	g/cm³
Melt Flow Rate (MFR, 260°C / 5 kg)	9 - 15	ISO 1133	g/10min
Filament Diameter	1.75 ± 0.03 / 2.85 ± 0.03	-	mm
Roundness Deviation	≤ 0.02	-	mm

Note: *Other spool formats and net weight specifications (e.g., 500 g, 750 g, 2 kg, 5 kg) are available upon request.*

4.2 Mechanical Properties

Property	Typical Value	Test Standard	Unit
Tensile Strength (XY)	45 ± 3	ISO 527-2 / ASTM D638	MPa
Tensile Modulus (XY)	2,500	ISO 527-2 / ASTM D638	MPa
Elongation at Break	4±1	ISO 527-2 / ASTM D638	%
Flexural Strength (XY)	73	ISO 178 / ASTM D790	MPa
Flexural Modulus (XY)	2,400	ISO 178 / ASTM D790	MPa
Izod Impact Strength (Notched)	7 - 9	ISO 180 / ASTM D256	kJ/m²
Charpy Impact Strength	8 - 10	ISO 179-1	kJ/m²
Shore D Hardness	81	ISO 868 / ASTM D2240	-

4.3 Thermal Properties

Property	Typical Value	Test Standard	Unit
Glass Transition Temperature (Tg)	109.7	ISO 11357-2 / ASTM D3418	°C
Heat Deflection Temperature (HDT @ 0.455 MPa)	103	ISO 75-2 / ASTM D648	°C

Heat Deflection Temperature (HDT @ 1.82 MPa)	92	ISO 75-2 / ASTM D648	°C
Vicat Softening Temperature	114	ISO 306 / ASTM D1525	°C
Processing Temperature Range	250 - 280	ISO 11357-2 / ASTM D3418	°C

4.4 Other Properties

Property	Typical Value	Test Standard	Unit
Water Absorption (24h)	0.2 - 0.4	ISO 62	%
Continuous Use Temperature	-20 to 100	-	°C

4.5 Flame Retardancy Properties

Property	Typical Value	Test Standard	Unit
Flame Retardancy Rating	V-0	UL 94	-
Test Specimen Thickness	1.5	UL 94	mm
Limited Oxygen Index (LOI)	30	ISO 4589 / ASTM D2863	%

Note: *All mechanical and thermal property values are based on 3D printed specimens printed under standard conditions (0.2 mm layer height, 100% infill, XY plane orientation) and conditioned at 23°C / 50% RH for 48 hours prior to testing. The flame-retardancy rating is determined on injection-molded test specimens at the listed thickness; 3D printed parts may exhibit different burning behavior depending on wall thickness, infill, and print orientation. PC-ABS-FR is an amorphous blend and does not have a sharp crystalline melting point; the listed "Melting Processing Temperature" represents the recommended melt-processing window. End users must verify compliance under their specific application and applicable regulatory framework.*

5. Storage & Handling

Storage Environment

- Store in a cool, dry environment with relative humidity below 30%
- Recommended storage temperature: 15°C - 25°C (59°F - 77°F)
- Avoid exposure to direct sunlight, UV radiation, or heat sources
- Keep original packaging sealed until ready for use

Packaging Requirements

- Vacuum-sealed aluminum-foil pouch with built-in desiccant
- Spool wound with consistent tension to prevent tangling and filament memory

- Material lot number, production date, and recommended print profile clearly marked

Desiccant Storage Recommendations

- Reuse of original packaging desiccants is not recommended after opening
- For extended storage, add food-grade silica gel desiccant to the storage container
- Store opened spools in airtight containers or filament dry boxes with fresh desiccant
- Filament dry boxes with integrated humidity monitoring are strongly recommended for active printers

Shelf Life

Under proper storage conditions, unopened PC-ABS-FR filament maintains optimal performance for 12 months from the production date. Once opened, the material should be used within 6 months for best results. Because the polycarbonate component is hygroscopic, opened spools should be stored in a sealed dry box and always re-dried before use if they have been exposed to ambient humidity for more than a few days.

Moisture Absorption Indicators

PC-ABS-FR contains polycarbonate, which is significantly more hygroscopic than standard ABS. SSSray filament is shipped in vacuum-sealed packaging with desiccant; however, if the seal is opened or compromised, the following signs indicate the material has absorbed moisture:

- Popping, hissing, or crackling sounds during extrusion
- Excessive stringing, oozing, and surface roughness on printed parts
- Bubbles, pockmarks, or micro-blisters visible on the printed surface
- Visible white streaks, foaming, or "silver" marks on extruded filament
- Reduced layer adhesion, surface gloss, and mechanical performance

Remediation: If moisture symptoms are observed, dry the filament at 8 0°C for 6 - 8 hours in a convection oven or dedicated filament dryer with good air circulation. Allow the spool to cool to room temperature inside the dryer before loading into the printer. Do not exceed the recommended drying temperature (80°C) or duration, as excessive heat may cause the polymer to soften, deform on the spool, or degrade. For best results, dry the filament and print it in the same session, or store it in a sealed dry box between prints. Note: PC hydrolysis is irreversible; always dry the filament before use.

6. Safety & Certifications

Certification	Status	Description
UL94 V-0 (1.5 mm)	Typical	Self-extinguishing within 10 seconds; no flaming drips; verified on standard test specimens
RoHS (Restriction of Hazardous Substances)	Compliant	Meets EU Directive 2011/65/EU on hazardous substance restrictions

CE Marking	Certified	Conforms to applicable EU safety and environmental directives
SDS (Safety Data Sheet)	Available	Detailed safety information available upon request
Third-Party Quality Verification	Available on Request	Independent testing reports can be provided as required (additional fees may apply)

Note: *The UL94 V-0 rating is determined on standardized test specimens. The burning behavior of 3D printed parts depends on wall thickness, infill, print orientation, and geometry, and may differ from the rating of standard test specimens. PC-ABS-FR printing at high temperatures (250°C+) requires an all-metal hot end, a hardened steel nozzle, and adequate ventilation. This product has not been certified for food-contact, drinking-water, or medical applications. Please contact our technical team for information on materials suitable for specific regulatory or compliance requirements.*

7. Performance Rating

Performance Dimension	Rating	Description
Printability	★★☆☆☆	Demanding - requires heated chamber, all-metal hot end, hardened steel nozzle, and thorough drying; recommended only for experienced users
Tensile Strength	★★★★☆	Very Good - engineering-grade strength suitable for load-bearing and structural applications
Heat Resistance	★★★★★	Excellent - HDT up to 103°C at 0.455 MPa, ideal for parts exposed to elevated service temperatures
Impact Resistance	★★★★☆	Very Good - high notched impact strength retained from the polycarbonate component despite the FR package
Flame Retardancy	★★★★★	Excellent - UL94 V-0 at 1.5 mm with low smoke emission, key feature of this grade

Target Applications: *PC-ABS-FR is optimized for users who require engineering-grade performance combined with self-extinguishing behavior for functional prototypes and end-use parts in ignition-risk environments. For applications requiring optical clarity, higher temperature performance, or easier printability, consider PC, PEI, or PETG-FR alternatives respectively.*

8. Troubleshooting Guide

Problem 1: Severe Warping / Corners Lifting

Possible Causes: Insufficient bed temperature, no heated chamber, large flat parts with high thermal stresses, drafts in the printing environment.

Solutions: Increase bed temperature to 105 - 110°C. Use an enclosed printer with a heated chamber at 70 - 90°C. Apply PC-compatible adhesion promoter (Magigoo PC, ABS slurry, or PEI sheet). Use a brim or raft for large flat parts. Avoid drafts by closing printer doors and shields.

Problem 2: Poor Layer Adhesion / Inter-layer Splitting

Possible Causes: Nozzle temperature too low, excessive cooling, print speed too high, ambient temperature too low.

Solutions: Increase nozzle temperature in 5°C increments up to 280°C. Keep layer fan at 0% or disable it entirely. Lower print speed to 30 - 40 mm/s. Use a heated chamber at 70 - 90°C. Verify the hot end is reaching and holding target temperature.

Problem 3: Popping, Hissing, or Bubbles During Extrusion

Possible Causes: Filament has absorbed moisture; vacuum seal was broken before use; long exposure to ambient humidity (PC component is hygroscopic).

Solutions: Dry the filament at 80°C for 6 - 8 hours in a convection oven or filament dryer before printing. Store opened spools in a sealed dry box with fresh desiccant. PC hydrolysis is irreversible; always dry before use. Verify the original vacuum bag was intact when received.

Problem 4: Rapid Brass Nozzle Wear or Orifice Enlargement

Possible Causes: FR additives in the filament are mildly abrasive and gradually enlarge the brass nozzle orifice; high printing temperature accelerates wear.

Solutions: Use a hardened steel or ruby-tipped nozzle for all PC-ABS-FR printing. Periodically check nozzle diameter and replace if flow rate increases, surface quality degrades, or underextrusion appears. Avoid mixing with other abrasive filaments in the same nozzle.

Problem 5: Excessive Stringing and Oozing

Possible Causes: Nozzle temperature too high, retraction distance or speed insufficient, wet filament.

Solutions: Reduce nozzle temperature by 5 - 10°C. Adjust retraction to 2 - 4 mm @ 30 - 50 mm/s. Dry the filament thoroughly at 80°C for 6 - 8 hours. Enable "wipe while retracting" or coast settings if available.

Problem 6: First-Layer Bed Adhesion Failure

Possible Causes: Bed temperature too low, incorrect Z-offset, no adhesion promoter, cold build plate.

Solutions: Increase bed temperature to 105 - 110°C. Re-calibrate the Z-offset / first-layer height to achieve proper squish. Apply PC-compatible adhesion promoter (Magigoo PC, ABS-juice, or PEI sheet). Pre-heat the chamber for 10 - 15 minutes before starting the print.

9. Disclaimer & Limitation of Liability

DISCLAIMER & LIMITATION OF LIABILITY

The typical values presented in this datasheet are intended for reference and comparison purposes only. They should not be used for design specifications or quality control purposes. Actual values may vary significantly with printing conditions, equipment calibration, environmental factors, and part design.

End-use performance of printed parts depends not only on material properties, but also on part design, wall thickness, print orientation, environmental conditions, printing parameters, and post-processing methods. Users should conduct their own testing to verify suitability for specific applications.

Product specifications are subject to change without notice. SSSRAY reserves the right to modify formulations and specifications to improve product quality or performance.

Each user is responsible for determining the safety, lawfulness, technical suitability, and disposal/recycling practices of SSSRAY materials for the intended application. SSSRAY makes no warranty of any kind, unless announced separately, as to the fitness for any particular use or application. SSSRAY shall not be held liable for any damage, injury, or loss induced from the use of SSSRAY materials in any application.

This document does not constitute technical advice. For technical support or custom formulation inquiries, please contact our technical team.

10. Document Revision History

Version	Issue Date	Author	Description
v3.0	2026-03-03	SSSray Technical	Product iteration - Comprehensive technical data update aligned with current production formulation
v2.0	2025-06-18	SSSray Technical	Product iteration - Updated specifications and formatting
v1.0	2024-01-15	SSSray Technical	Initial release

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