



SPECIALTIES

FUSED DEPOSITION MODELING FILAMENTS



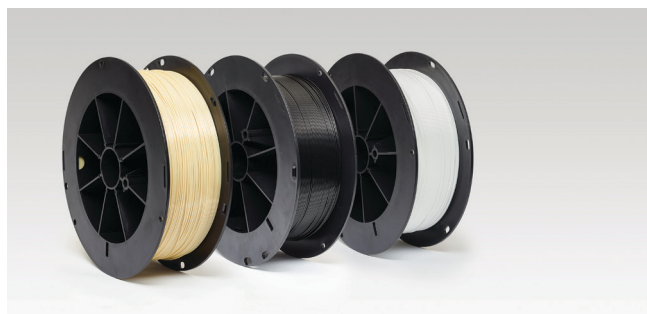
CHEMISTRY THAT MATTERS™

ADVANCING ADDITIVE MANUFACTURING

SABIC is focused on accelerating the technology required to support the use of additive manufacturing for finished part production.

You may already know us as a global supplier of ULTEM™ resin for additively manufactured FST compliant aerospace applications and for our collaboration with Local Motors in the large format printing of the Strati vehicle in 2014.

We are now expanding our focus to include the development of differentiated materials formulated specifically for additive manufacturing to help designers meet functional application requirements.



Building upon our foundation in additive manufacturing technology and our depth of material knowledge, SABIC now offers a portfolio of filament products to support our customers in their optimization of fused deposition modeling technology.

Our current product offering is based on commercial grades of SABIC's thermoplastic resins including ULTEM resin (PEI), LEXAN™ resin (PC) and CYCOLAC™ resin (ABS). Available for use in Stratasys® Fortus® Classic printers, as well as other printers with sufficient temperature capability and an open-format architecture, these materials provide customers with a choice in filament supply that can help enable consistent production of high performing, durable parts.

DEVELOPING DIFFERENTIATED MATERIALS

Leveraging our broad range of engineering thermoplastics and process capabilities, we are continually developing new filaments for our growing portfolio. These materials with unique performance characteristics can allow OEMs to meet the specification requirements of their applications for industries including aerospace, healthcare, automotive and consumer products.

HELPING DESIGNERS ATTAIN NEW LEVELS OF APPLICATION PERFORMANCE

The first in a series of distinctive filaments to be launched in the coming months, EXL AMHI240F filament, based on SABIC's EXL polycarbonate copolymer technology, offers outstanding impact strength and ductility at room temperature and at temperatures down to -30 °C.

Compared to competitive PC, this material delivers an improvement in notched Izod impact of up to 4 times at room temperature and up to 3 times at -30 °C, depending on print orientation. See Figure 1.

The EXL filament has a heat deflection temperature of 140 °C, which is higher than that of general-purpose acrylonitrile-butadiene-styrene (ABS) filaments. This property makes the SABIC filament a potential candidate for end use applications that operate at elevated temperatures.

The black color filament complies with Underwriters Laboratories' UL94 V-0 flammability standard at 3.0 mm in flat (XY) and on-edge (XZ) print orientations, making it appropriate for a broad range of applications requiring fire resistance. See Figure 2 and Figure 3.

SABIC's EXL AMHI240F filament shows improved ductility over competitive PC filament in multi-axial impact testing. The filament is available in black and white colors.

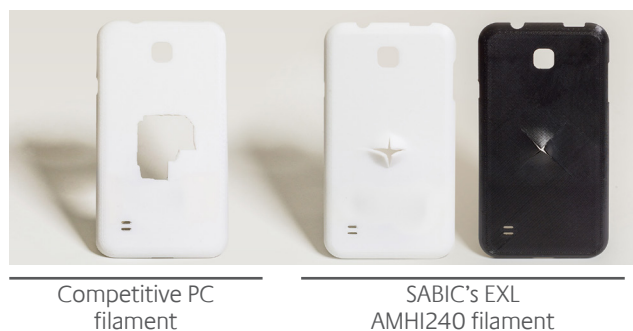


FIGURE 1

Notched Izod impact strength comparison of EXL filament and competitive PC filament at room temperature and -30 °C

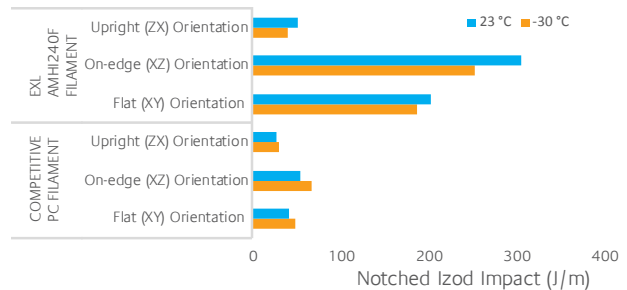


FIGURE 2

Total flame out times of parts printed with EXL filament compared to standard PC filament

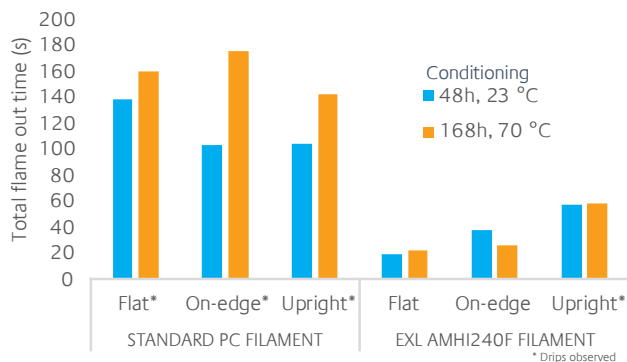
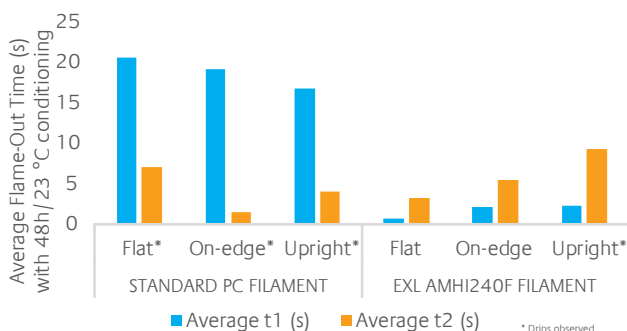


FIGURE 3

Average individual flame-out times with 48h, 23 °C conditioning. The same trends were observed for 168h, 70 °C conditioning



Filament Datasheets

EXL AMHI240F FILAMENT

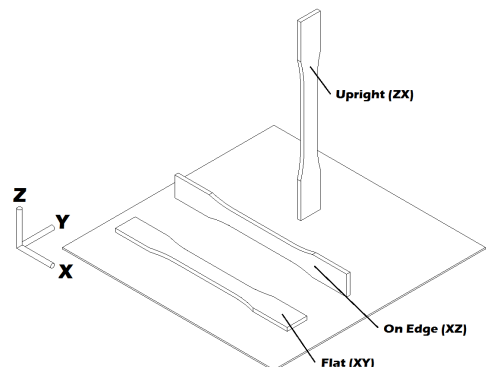
EXL AMHI240F filament is a high impact polycarbonate product available in black and white colors. It provides high impact strength at room temperature and extreme low temperatures, in combination with improved UL94 performance over standard polycarbonate.

TYPICAL PROPERTY VALUES◇

PROPERTY	TEST METHOD	UNITS	XY ORIENTATION	XZ ORIENTATION	ZX ORIENTATION
MECHANICAL					
Tensile Modulus	ASTM D638	MPa	1700	1900	1790
Tensile Stress, brk, Type I, 5 mm/min	ASTM D638	MPa	45	55	40
Tensile Strain, brk, Type I, 5 mm/min	ASTM D638	%	7	5	3
Flexural Modulus, 1.3 mm/min	ASTM D790	MPa	1510	1900	1470
Izod Impact, notched, 23°C	ASTM D256	J/m	205	310	55
Izod Impact, notched, -30°C	ASTM D256	J/m	190	255	40
Izod Impact, un-notched, 23°C	ASTM D256	J/m	845	810	260
Izod Impact, un-notched, -30°C	ASTM D256	J/m	975	860	300
THERMAL					
HDT, 1.82 MPa, 3.2 mm, unannealed	ASTM D648	°C	140	139	138
Vicat Softening Temp, Rate A/50	ASTM D1525	°C	148	149	149
Coefficient of Thermal Expansion - flow	ASTM E831	$\mu\text{m}/(\text{m}\cdot^{\circ}\text{C})$	77	80	79
Coefficient of Thermal Expansion - x-flow	ASTM E831	$\mu\text{m}/(\text{m}\cdot^{\circ}\text{C})$	77	81	80
ELECTRICAL					
Volume Resistivity	ASTM D257	ohm-cm	3.2E+14	2.4E+14	
FLAME CHARACTERISTICS					
UL94 Flame Class Rating, 3.0 mm*	UL94		V-0	V-0	V-2

◇Typical values only. Not intended for design or specification purposes. Variations within normal tolerances are possible for various colors. Test coupons were printed using a Stratasys® FORTUS® 900mc printer under standard parameters unless otherwise noted.

* UL results provided herein may not be sufficient to waive end use part testing for UL listing. Contact UL for further details.



ULTEM™ AM9085F FILAMENT

ULTEM AM9085F filament is a high performance polyetherimide blend product manufactured from ULTEM™ 9085 resin. It is available in black and natural (unpigmented) colors. It provides high heat resistance and mechanical strength, is UL94 V-0 compliant at 1.5 and 3.0 mm, and meets FAR 25.853 and OSU 65/65 with low toxicity, smoke, and flame evolution.

TYPICAL PROPERTY VALUES◇

PROPERTY	TEST METHOD	UNITS	XY ORIENTATION	XZ ORIENTATION	ZX ORIENTATION
MECHANICAL					
Tensile Modulus	ASTM D638	MPa	2176	2555	2439
Tensile Stress, brk, Type I, 5 mm/min	ASTM D638	MPa	62	80	45
Tensile Strain, brk, Type I, 5 mm/min	ASTM D638	%	5.1	5.8	2.3
Flexural Modulus, 1.3 mm/min	ASTM D790	MPa	2126	2550	2070
Izod Impact, notched, 23°C*	ASTM D256	J/m	104	100	33
Izod Impact, un-notched, 23°C*	ASTM D256	J/m	763	1003	131
THERMAL					
HDT, 1.82 MPa, 3.2 mm, unannealed	ASTM D648	°C	175	175	165
Coefficient of Thermal Expansion - flow	ASTM E831	µm/(m•°C)	57.1	60.6	62.1
Coefficient of Thermal Expansion - x-flow			58.3	61.1	62.9
ELECTRICAL					
Volume Resistivity	ASTM D257	ohm-cm	1.07E+15	1.1E+15	
Dielectric Constant - 100 MHz	ASTM D150	-	2.54	2.73	
Dissipation Factor - 100 MHz	ASTM D150	-	0.00233	0.003	
Dielectric Constant - 500 MHz	ASTM D150	-	2.53	2.72	
Dissipation Factor - 500 MHz	ASTM D150	-	0.005	0.00567	
Dielectric Constant - 1000 MHz	ASTM D150	-	2.52	2.71	
Dissipation Factor - 1000 MHz	ASTM D150	-	0.004	0.004	
FLAME CHARACTERISTICS					
UL94 Flame Class Rating, 1.5 and 3.0 mm** UL94			V-0	V-0	V-0
FAA Flammability	FAR 25.853	-	Passed (1.5mm)		
OSU total heat release (2 minute test)	FAR 25.853	kW-min/m²	44 (1.5mm)		
OSU peak heat release rate (5 minute test)	FAR 25.853	kW/m²	45 (1.5mm)		
Vertical Burn (60s)	FAR 25.853		Passed (1.5mm, 0 sec)		
Vertical Burn (12s)	FAR 25.853		Passed (1.5mm, 0 sec)		

◇Typical values only. Not intended for design or specification purposes. Variations within normal tolerances are possible for various colors. Test coupons were printed using a Stratasys® FORTUS® 900mc printer under standard parameters unless otherwise noted.

* Izod impact strength test coupons were printed using a Stratasys® FORTUS® 900mc printer at high print density (88.5%).

** UL results provided herein may not be sufficient to waive end use part testing for UL listing. Contact UL for further details.

ULTEM™ AM1010F FILAMENT

ULTEM AM1010F filament is a polyetherimide product for 3D printing applications manufactured from ULTEM 1010 resin. The filament provides high heat resistance and mechanical strength, is UL94 V-0 compliant at 1.5 mm and 5VA compliant at 3.0 mm.

TYPICAL PROPERTY VALUES◇

PROPERTY	TEST METHOD	UNITS	XY ORIENTATION	XZ ORIENTATION	ZX ORIENTATION
MECHANICAL					
Tensile Modulus	ASTM D638	MPa	2750	2865	2840
Tensile Stress, brk, Type I, 5 mm/min	ASTM D638	MPa	73	80	34
Tensile Strain, brk, Type I, 5 mm/min	ASTM D638	%	4.0	3.8	1.3
Flexural Modulus, 1.3 mm/min	ASTM D790	MPa	2520	2840	2380
Izod Impact, notched, 23°C	ASTM D256	J/m	31	37	30
Izod Impact, un-notched, 23°C	ASTM D256	J/m	273	240	128
THERMAL					
HDT, 1.82 MPa, 3.2 mm, unannealed	ASTM D648	°C	211	210	208
Vicat Softening Temp, Rate B/50	ASTM D1525	°C	220	220	220
Coefficient of Thermal Expansion - flow	ASTM E831	µm/(m•°C)	51	53	53
Coefficient of Thermal Expansion - x-flow	ASTM E831	µm/(m•°C)	53	52	53
ELECTRICAL					
Volume Resistivity	ASTM D257	ohm-cm	6.24E+14	1.26E+15	
Dielectric Constant (1.9 GHz)	ASTM D150	-	2.9	2.9	
Dissipation Factor (1.9 GHz)	ASTM D150	-	0.003	0.003	
FLAME CHARACTERISTICS					
UL94 Flame Class Rating, 1.5 mm*	UL94		V-0	V-0	V-0
UL94 Flame Class Rating, 3.0 mm*	UL94		5VA		
FAA Flammability	FAR 25.853	-	Passed (1.5 mm)		
OSU total heat release (2 minute test)	FAR 25.853	kW-min/m²	5 (1.5 mm)		
OSU peak heat release rate (5 minute test)	FAR 25.853	kW/m²	23 (1.5 mm)		
Vertical Burn (60 s)	FAR 25.853		Passed (1.5 mm, 2 s)		
Vertical Burn (12 s)	FAR 25.853		Passed (1.5 mm, 0 s)		

◇Typical values only. Not intended for design or specification purposes. Variations within normal tolerances are possible for various colors. Test coupons were printed using a Stratasys® FORTUS® 900mc printer under standard parameters unless otherwise noted.

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ULTEM™ AMHU1010F FILAMENT

ULTEM AMHU1010F filament is a polyetherimide product for 3D printing applications manufactured from ULTEM HU1010 resin. The filament is biocompatible (ISO 10993 or USP Class VI) and printed parts can be gamma, EtO or steam sterilized. This filament can be used for food and drug packaging and medical device manufacturing, from conceptual modeling to functional prototyping and end-use parts. Filament spools can be linked to resin raw material batch to help ensure material compliance and traceability.*

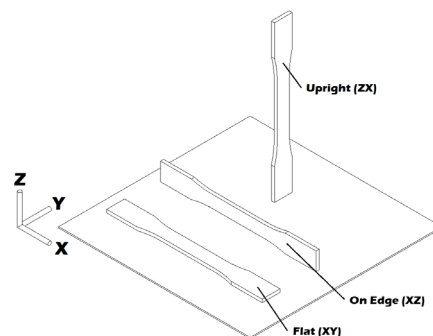
TYPICAL PROPERTY VALUES◇

PROPERTY	TEST METHOD	UNITS	XY ORIENTATION	XZ ORIENTATION	ZX ORIENTATION
MECHANICAL					
Tensile Modulus	ASTM D638	MPa	2750	2865	2840
Tensile Stress, brk, Type I, 5 mm/min	ASTM D638	MPa	73	80	34
Tensile Strain, brk, Type I, 5 mm/min	ASTM D638	%	4.0	3.8	1.3
Flexural Modulus, 1.3 mm/min	ASTM D790	MPa	2520	2840	2380
Izod Impact, notched, 23°C	ASTM D256	J/m	31	37	30
Izod Impact, un-notched, 23°C	ASTM D256	J/m	273	240	128
THERMAL					
HDT, 1.82 MPa, 3.2 mm, unannealed	ASTM D648	°C	211	210	208
Vicat Softening Temp, Rate A/50	ASTM D1525	°C	220	220	220
Coefficient of Thermal Expansion - flow	ASTM E831	µm/(m•°C)	51	53	53
Coefficient of Thermal Expansion - x-flow	ASTM E831	µm/(m•°C)	53	52	53
ELECTRICAL					
Volume Resistivity	ASTM D257	ohm-cm	6.24E+14	1.26E+15	
Dielectric Constant (1.9 GHz)	ASTM D150	-	2.9	2.94	
Dissipation Factor (1.9 GHz)	ASTM D150	-	0.003	0.003	
FLAME CHARACTERISTICS					
UL94 Flame Class Rating, 1.5 mm**	UL94		V-0	V-0	V-0
UL94 Flame Class Rating, 3.0 mm**	UL94		5VA		

◇Typical values only. Not intended for design or specification purposes. Variations within normal tolerances are possible for various colors. Test coupons were printed using a Stratasys® FORTUS® 900mc printer under standard parameters unless otherwise noted.

*It is the responsibility of the finished device manufacturer to determine the suitability of all the component parts and materials used in their finished products. SABIC does not recommend and will not support the use of any of SABIC's products in medical devices intended to remain continuously in the human body for longer than 29 days.

**UL results provided herein may not be sufficient to waive end use part testing for UL listing. Contact UL for further details.



AMHC620F FILAMENT

AMHC620F is a white polycarbonate filament for 3D printing applications. The filament is biocompatible (ISO 10993, USP Class VI) and printed parts can be gamma or ETO sterilized. This filament can be used for food and drug packaging and medical device manufacturing, from conceptual modeling to functional prototyping and end-use parts. Filament spools can be linked to resin raw material batch to ensure material compliance and traceability.*

TYPICAL PROPERTY VALUES◇

PROPERTY	TEST METHOD	UNITS	XY ORIENTATION	XZ ORIENTATION	ZX ORIENTATION
MECHANICAL					
Tensile Modulus	ASTM D638	MPa	1830	2110	2190
Tensile Stress, brk, Type I, 5 mm/min	ASTM D638	MPa	51	62	54
Tensile Strain, brk, Type I, 5 mm/min	ASTM D638	%	5.1	5.5	3.3
Flexural Modulus, 1.3 mm/min	ASTM D790	MPa	1720	2110	1970
Izod Impact, notched, 23°C	ASTM D256	J/m	40	47	31
Izod Impact, un-notched, 23°C	ASTM D256	J/m	730	480	130

THERMAL

HDT, 1.82 MPa, 3.2 mm, unannealed	ASTM D648	°C	142	142	140
Vicat Softening Temp, Rate 50/120B	ASTM D1525	°C	147	147	146
Coefficient of Thermal Expansion - flow (-40 to 95 °C)	ASTM E831	µm/(m·°C)	74	73	74
Coefficient of Thermal Expansion - x-flow	ASTM E831	µm/(m·°C)	74	77	75

ELECTRICAL

Volume Resistivity	ASTM D257	ohm-cm	1.1E+13	3.4E+14	3.4E+14
Relative Permittivity (1.9 GHz)	ASTM D150	-	2.6	2.7	2.7
Dissipation Factor (1.9 GHz)	ASTM D150	-	0.005	0.005	0.005

FLAME CHARACTERISTICS

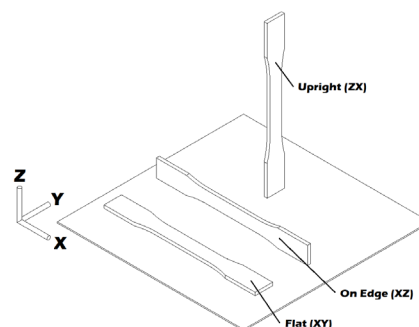
UL94 Flame Class Rating, 1.5 mm**	UL94	HB	HB	HB
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◇Typical values only. Not intended for design or specification purposes. Variations within normal tolerances are possible for various colors. Test coupons were printed using a Stratasys® FORTUS® 900mc printer under standard parameters unless otherwise noted.

*It is the responsibility of the finished device manufacturer to determine the suitability of all the component parts and materials used in their finished products.

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AM1110F FILAMENT

AM1110F filament is a general purpose polycarbonate product manufactured from LEXAN™ HF1110 resin. It is only available in white. It provides thermal properties above that of general purpose ABS filaments and is UL94 V-2 compliant at 3.0 mm.

TYPICAL PROPERTY VALUES◇

PROPERTY	TEST METHOD	UNITS	XY ORIENTATION	XZ ORIENTATION	ZX ORIENTATION
MECHANICAL					
Tensile Modulus	ASTM D638	MPa	2025	2201	1959
Tensile Stress, brk, Type I, 5 mm/min	ASTM D638	MPa	55	66	45
Tensile Strain, brk, Type I, 5 mm/min	ASTM D638	%	5.8	5.9	2.8
Flexural Modulus, 1.3 mm/min	ASTM D790	MPa	1876	2231	1832
Izod Impact, notched, 23°C*	ASTM D256	J/m	52	61	30
Izod Impact, un-notched, 23°C*	ASTM D256	J/m	410	1385	189
THERMAL					
HDT, 1.82 MPa, 3.2 mm, unannealed	ASTM D648	°C	143	142	141
Coefficient of Thermal Expansion - flow	ASTM E831	µm/(m•°C)	70.2	70.6	72.9
Coefficient of Thermal Expansion - x-flow			69.2	71.8	73.9
ELECTRICAL					
Volume Resistivity	ASTM D257	ohm-cm	1.08E+14	5.78E+14	
Dielectric Constant - 100 MHz	ASTM D150	-	2.37	2.54	
Dissipation Factor - 100 MHz	ASTM D150	-	0.004	0.005	
Dielectric Constant - 500 MHz	ASTM D150	-	2.35	2.52	
Dissipation Factor - 500 MHz	ASTM D150	-	0.00667	0.007	
Dielectric Constant - 1000 MHz	ASTM D150	-	2.32	2.5	
Dissipation Factor - 1000 MHz	ASTM D150	-	0.005	0.005	
FLAME CHARACTERISTICS					
UL94 Flame Class Rating, 3.0 mm**	UL94		V-2	V-2	V-2

◇ Typical values only. Not intended for design or specification purposes. Variations within normal tolerances are possible for various colors. Test coupons were printed using a Stratasys® FORTUS® 900mc printer under standard parameters unless otherwise noted.

* Izod impact strength test coupons were printed using a Stratasys® FORTUS® 900mc printer at high print density (94.2%).

** UL results provided herein may not be sufficient to waive end use part testing for UL listing. Contact UL for further details.

AMMG94F FILAMENT

AMMG94F filament is a general purpose ABS product manufactured from CYCOLACT™ MG94 resin. It is available in black, white, and natural (unpigmented) colors. It provides a balance of properties suitable for a wide variety of applications and is UL94 HB compliant at 3.0 mm.

TYPICAL PROPERTY VALUES◇

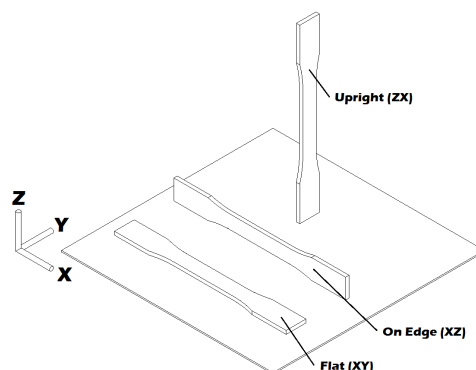
PROPERTY	TEST METHOD	UNITS	XY ORIENTATION	XZ ORIENTATION	ZX ORIENTATION
MECHANICAL					
Tensile Modulus	ASTM D638	MPa	2065	2132	2030
Tensile Stress, brk, Type I, 5 mm/min	ASTM D638	MPa	26	27	26
Tensile Strain, brk, Type I, 5 mm/min	ASTM D638	%	6.9	5.9	1.8
Flexural Modulus, 1.3 mm/min	ASTM D790	MPa	1997	2107	1772
Izod Impact, notched, 23°C*	ASTM D256	J/m	163	140	59
Izod Impact, un-notched, 23°C*	ASTM D256	J/m	330	324	122
THERMAL					
HDT, 1.82 MPa, 3.2 mm, unannealed	ASTM D648	°C	100	100	98
Coefficient of Thermal Expansion - flow	ASTM E831	μm/(m·°C)	76.3	76.7	82.4
Coefficient of Thermal Expansion - x-flow			75.4	76.8	79.2
ELECTRICAL					
Volume Resistivity	ASTM D257	ohm-cm	4.13E+14	1.31E+15	
Dielectric Constant - 100 MHz	ASTM D150	-	2.44	2.46	
Dissipation Factor - 100 MHz	ASTM D150	-	0.003	0.003	
Dielectric Constant - 500 MHz	ASTM D150	-	2.43	2.45	
Dissipation Factor - 500 MHz	ASTM D150	-	0.006	0.006	
Dielectric Constant - 1000 MHz	ASTM D150	-	2.41	2.43	
Dissipation Factor - 1000 MHz	ASTM D150	-	0.005	0.005	
FLAME CHARACTERISTICS					
UL94 Flame Class Rating, 3.0 mm**	UL94		HB	HB	HB

◇ Typical values only. Not intended for design or specification purposes. Variations within normal tolerances are possible for various colors.

Test coupons were printed using a Stratasys® FORTUS® 400mc printer under standard parameters unless otherwise noted.

* Izod impact strength test coupons were printed using a Stratasys® FORTUS® 900mc printer at high print density (94.9%).

** UL results provided herein may not be sufficient to waive end use part testing for UL listing. Contact UL for further details.



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