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MATERIAL **ULTEM™ 1010 RESIN** OVERVIEW

For more information or advice:



theD2Mco.com/contact-us



info@theD2Mco.com

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.

Contents:

Ordering Information	3
Physical Properties	4
Mechanical Properties.....	5
Outgassing	7
Appendix.....	8





Ordering Information

Table 1 – Printer and Support Material Compatibility

Printer	Model Tip	Layer Height	Support Material	Support Tip
Fortus 450mc™	T14	0.254 mm (0.010 in)	SUP9000B	T16
	T20	0.3302 mm (0.013 in)		
F900®	T14	0.254 mm (0.010 in)	SUP9000B	T16
	T20	0.3302 mm (0.013 in)		
	T40A	0.508 mm (0.020 in)		T20

Build Sheet

High Temperature

- 0.02 x 26 x 38 in. (0.51 x 660 x 965 mm)
- 0.02 x 16 x 18.5 in. (0.51 x 406 x 470 mm)

System Requirements¹

Fortus 450mc

- Standard Fortus 450mc head
- ULTEM™ 1010 resin material license (included with All Material License)

F900

- Standard F900 head
- ULTEM™ 1010 resin material license

Table 2 – ULTEM™ 1010 Resin Ordering Information

Part Number	Description
Filament Canisters^{2 3}	
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	SUP9000B Support, 92.3 cu in. - Plus
310-31000	SUP9000B Support, 92.3 cu in. - Classic
Printer Consumables	
511-12000	T14 tip
511-10701	T20 tip
511-10750	T40A tip
511-10401	T16 tip
325-00275-S	High Temperature build sheet, 0.02x16x18.5 in. (0.51x406x470 mm)
325-00475-S	High Temperature build sheet, 0.02x26x38 in. (0.51x660x965 mm)
310-00300	High Temperature build sheet, 0.03x16x18.5 in. (0.76x406x470 mm)
Print Heads	
821724-XXXX	Standard Fortus 450mc head ⁴
404210-XXXX	Standard F900 head ⁵

¹ Contact your Stratasys representative for ordering information.

² Classic canisters are compatible with Fortus 900mc printers prior to s/n L502.

³ Plus canisters are compatible with all Fortus 450mc, all Stratasys F900, and Fortus 900mc printers s/n L502 and up.

⁴ The standard Fortus 450mc head is easily identified by a silver formed rod handle.

⁵ The standard F900 head is easily identified by a silver formed rod handle.



Physical Properties

Values are measured as printed. XY, XZ, and ZX orientations were tested.

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 µm/[m*°C] (20.04 µin/[in*°F])	-
	ASTM E831 (60 °C to 205 °C)	29.81 µm/[m*°C] (16.56 µin/[in*°F])	-
	ASTM E831 (-50 °C to 110 °C)	-	32.50 µm/[m*°C] (18.06 µin/[in*°F])
	ASTM E831 (110 °C to 165 °C)	-	16.19 µm/[m*°C] (8.995 µin/[in*°F])
	ASTM E831 (165 °C to 200 °C)	-	4.291 µm/[m*°C] (2.384 µin/[in*°F])
Volume Resistivity	ASTM D257	>7.00*10 ¹⁴ Ω*cm	
Dielectric Constant	ASTM D150 1 kHz test condition	2.841	2.888
	ASTM D150 2 MHz test condition	3.089	3.156
Dissipation Factor	ASTM D150 1 kHz test condition	-0.002	-0.002
	ASTM D150 2 MHz test condition	0.000	0.000
Thermal Conductivity	ASTM E1952 @0C	0.2430 W/m*K 0.1404 BTU/(hr*ft*F)	
Thermal Conductivity	ASTM E1952 @30C	0.2420 W/m*K 0.1399 BTU/(hr*ft*F)	
Thermal Conductivity	ASTM E1952 @60C	0.2426 W/m*K 0.1399 BTU/(hr*ft*F)	
Thermal Conductivity	ASTM E1952 @90C	0.2417 W/m*K 0.1402 BTU/(hr*ft*F)	
Thermal Diffusivity	ASTM E1952 @0C	0.158 mm²/s 2.45*10 ⁻⁴ in²/s	
Thermal Diffusivity	ASTM E1952 @30C	0.141 mm²/s 2.19*10 ⁻⁴ in²/s	
Thermal Diffusivity	ASTM E1952 @60C	0.130 mm²/s 2.02*10 ⁻⁴ in²/s	
Thermal Diffusivity	ASTM E1952 @90C	0.121 mm²/s 1.88*10 ⁻⁴ in²/s	
Specific Gravity	ASTM D257 @23 °C	1.29	
UL Flammability	ANSI/UL 746B	V0- Blue Card #E345258	

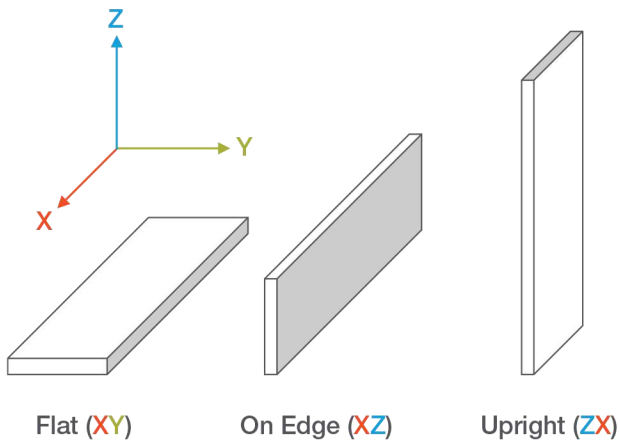


Mechanical Properties

ULTEM™ 1010 resin samples were printed with a 0.254 mm (0.010 in.) layer height on the F900.

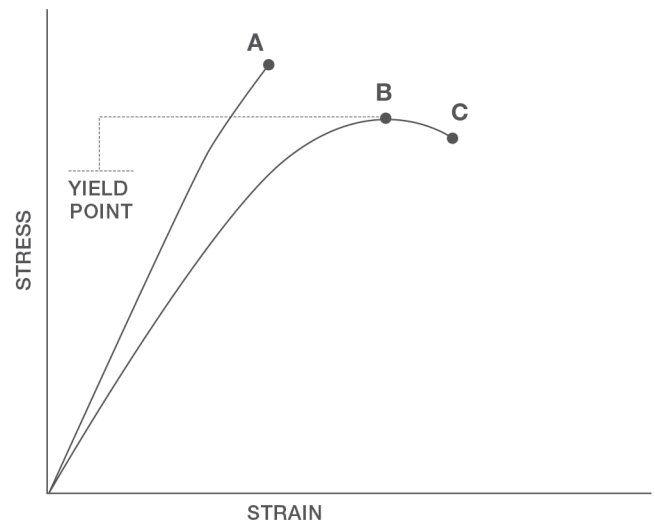
Print Orientation

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 (F900 - T14 Tip)

		XZ Orientation ¹	ZX Orientation ¹
Tensile Properties: ASTM D638			
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)
Flexural Properties: ASTM D790, Procedure A			
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)
Compression Properties: ASTM D695			
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)
Impact Properties: ASTM D256, ASTM D4812			
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)

¹ Values in parentheses are standard deviations.



Outgassing

ULTEM™ 1010 resin, natural, was printed with a 0.254 mm (0.010 in.) layer height 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
Testing Observations ¹			
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		

¹Observations apply to all tested samples



Appendix

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

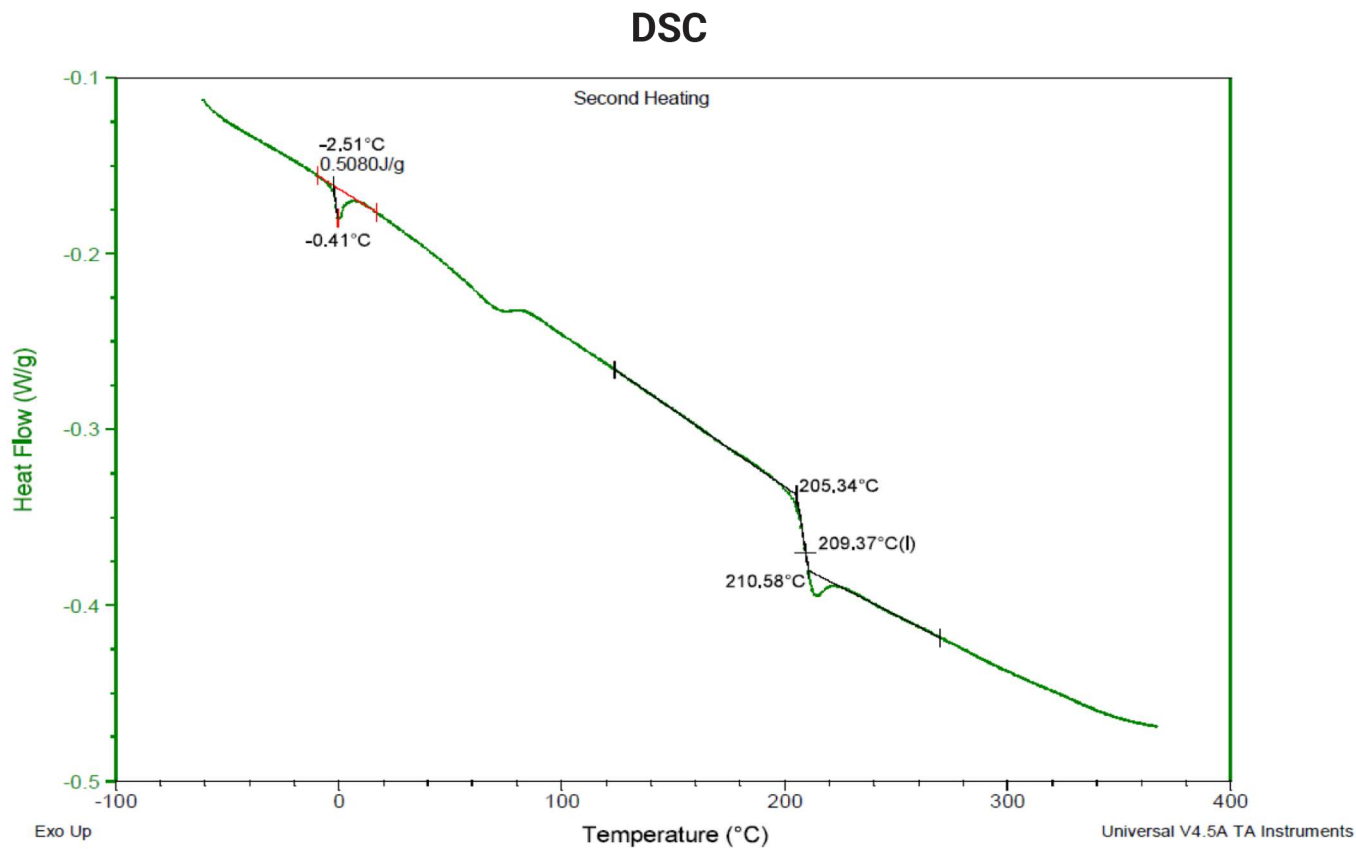




Figure 2 – Dimension change data as a function of temperature for the ULTEM™ 1010 resin Flat (XY) sample.

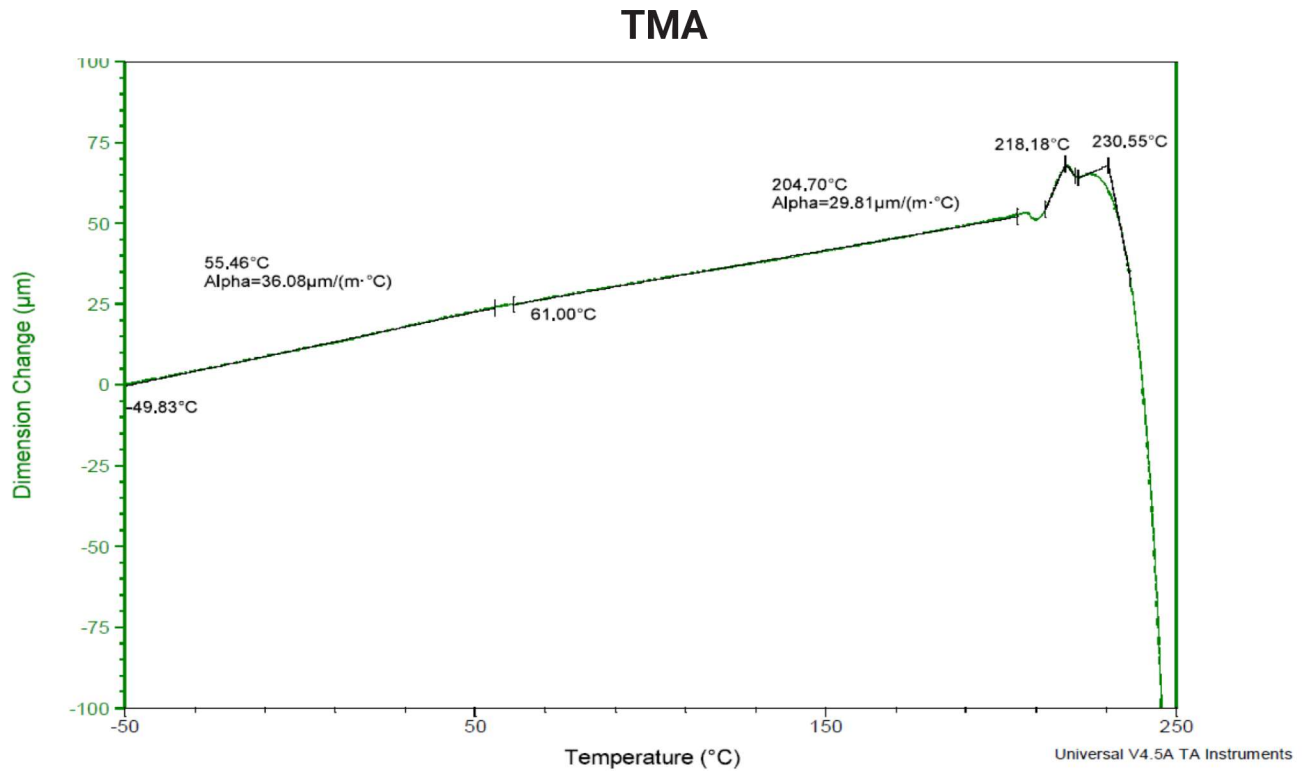


Figure 3 – Dimension change data as a function of temperature for the ULTEM™ 1010 resin On Edge (XZ) sample.

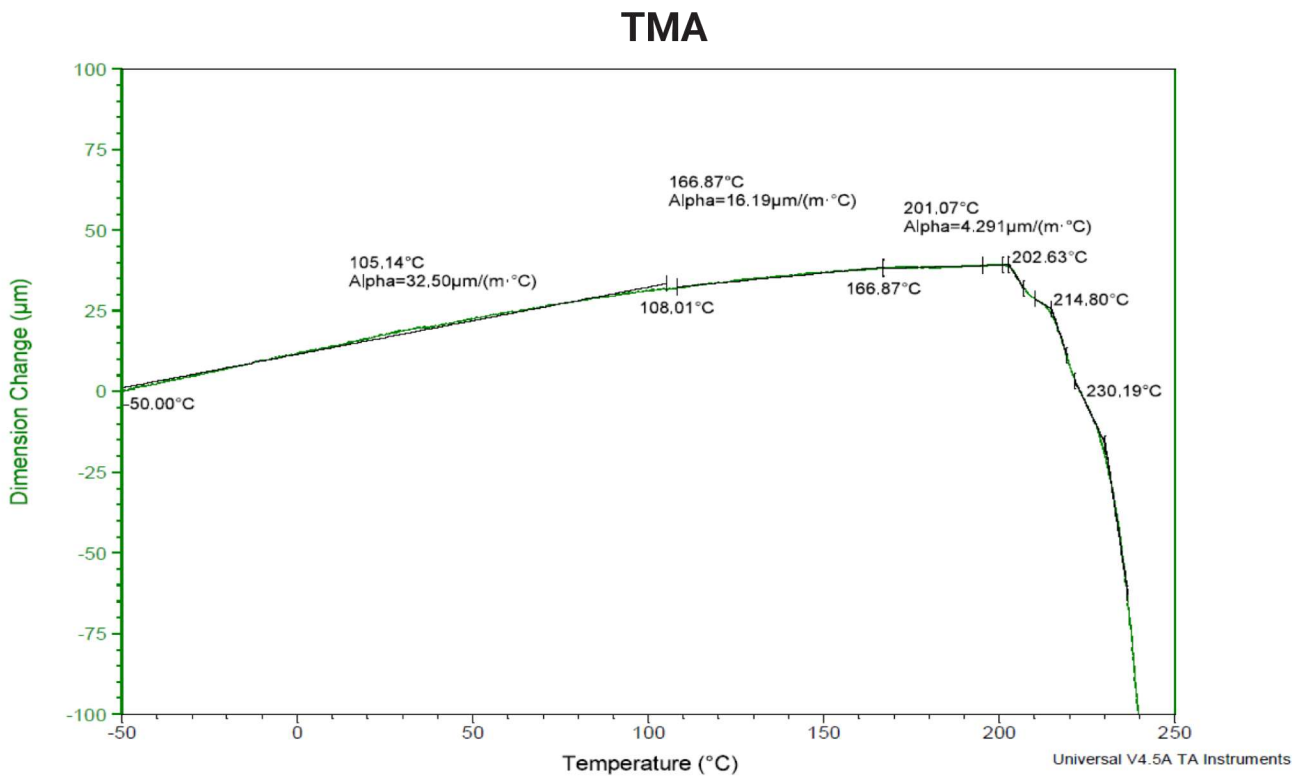
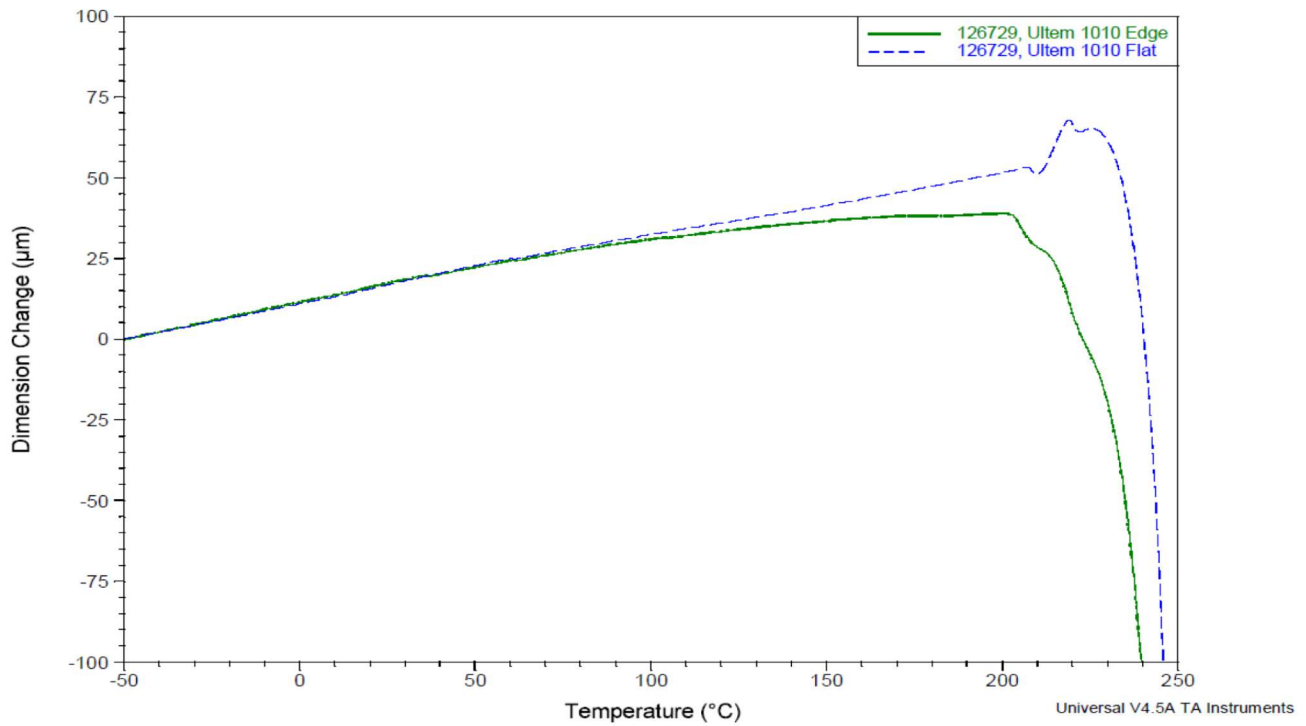




Figure 4 – Overlay of the dimension change data for the Flat (XY) and On Edge (XZ) ULTEM™ 1010 resin samples.

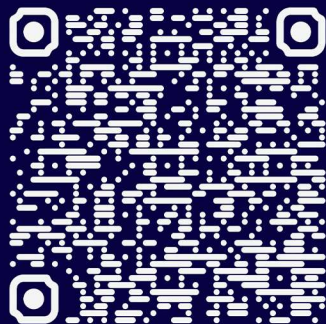


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