DuPont™ Kapton® HPP-ST

POLYIMIDE FILM

Technical Data Sheet

DuPont™ Kapton® HPP-ST is a two-sided, treated film that offers the same excellent balance of physical, chemical, and electrical properties over a wide temperature range offered by general purpose Kapton® HN. Additionally, this high performance film has superior dimensional stability and excellent adhesion with most adhesion systems. Adhesion data for HPP-ST can be referenced in the adhesion to Kapton® technical bulletin.

In applications where low shrinkage and superior adhesion are important, Kapton® HPP-ST is the polyimide film of choice.

Applications

- Electronic parts
- PCB stencils
- Screen printing
- Insulation tubing

Product Specifications

Kapton® HPP-ST is manufactured, slit and packaged according to the product specifications listed in H-38479, Bulletin GS-96-7.

Certification

Kapton® HPP-ST meets ASTM D-5213 (type 1, item A) requirements.

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Table 1
Typical Properties of Kapton® HPP-ST at 23°C (73°F)

Property	Unit	1 mil 25µm	2 mil 50µm	3 mil 75µm	5 mil 125µm	Test Method
Physical						
Tensile Strength	kpsi (MPa)	34 (234)	34 (234)	34 (234)	34 (234)	ASTM D-882-91
Elongation	%	80	82	82	82	ASTM D-882-91
Tensile Modulus	kpsi (GPa)	400 (2.8)	400 (2.8)	400 (2.8)	400 (2.8)	ASTM D-882-91
Adhesion	pli (N/mm)	10 (1.8)	10 (1.8)	10 (1.8)	10 (1.8)	IPC-TM-650 Method 2.4.9*
Density	g/cc	1.42	1.42	1.42	1.42	ASTM D-1505-90
MIT Folding Endurance	cycles	285,000	55,000	6,000	3,000	ASTM D-2176-89
Tear Strength-propagating (Elmendorf), N		0.07	0.21	0.38	0.58	ASTM D-1922-89
Tear Strength, initial (Graves), N		7.2	16.3	26.3	46.9	ASTM D-1004-90
Thermal						
Flammability		94V0	94V0	94V0	94V0	UL-94
Shrinkage (30 min at 150°C)	%	0.03	0.03	0.03	0.03	IPC-TM-650 Method 2.2.4A
Limiting Oxygen Index	%	37	43	46	45	ASTM D-2863-87
Electrical						
Dielectric Strength	kV/mil (kV/mm)	7.7 (303)	6.1 (240)	5.2 (205)	3.9 (154)	ASTM D-149-91
Dielectric Constant	1kHz	3.4	3.4	3.5	3.5	ASTM D-150-92
Dissipation Factor at 1 kHz		0.0018	0.0020	0.0020	0.0026	ASTM D-150-92
Volume Resistivity	ohm-cm	1.5×10^{17}	1.5×10^{17}	1.4×10^{17}	1.0×10^{17}	ASTM D-257-91

*Acrylic adhesive to 1 oz. copper

Table 2
Physical Properties of Kapton® HPP-ST Film

Physical Property	Typical Value at 23°C (73°F)	200°C (392°F)	Test Method
Yield Point at 3%, MPa (psi)	69 (10,000)	41 (6000)	ASTM D-882-91
Stress to produce 5% elongation, MPa (psi)	90 (13,000)	61 (9000)	ASTM D-882-91
Impact Strength, N•cm•(ft lb)	78 (0.58)		DuPont Pneumatic Impact Test
Coefficient of Friction, kinetic (film-to-film)	0.48		ASTM D-1894-90
Coefficient of Friction, static (film-to-film)	0.63		ASTM D-1894-90
Refractive Index (sodium D line)	1.70		ASTM D-542-90
Poisson's Ratio	0.34		Avg. three samples Elongated at 5%, 7%, 10%
Low Temperature Flex Life	pass		IPC-TM 650, Method 2.6.18

Table 3
Thermal Properties of Kapton® HPP-ST Film

Thermal Property	Typical Value	Test Condition	Test Method
Melting Point	None	None	ASTM E-794-85 (1989)
Thermal Coefficient of Linear Expansion	20 ppm/°C (11 ppm/°F)	-14 to 38°C (7 to 100°F)	ASTM D-696-91
Coefficient of Thermal Conductivity, W/m-K $\frac{cal}{cm \bullet sec \bullet °C}$	0.12 2.87×10^4	296 K 23°C	ASTM F-433-77 (1987)
Specific Heat, J/g K (cal/g °C)	1.09 (0.261)		Differential calorimetry
Heat Sealability	not heat sealable		
Solder Float	pass		IPC-TM-650, method 2.4.13A
Smoke Generation	D_m=<1	NBS smoke chamber	NFPA-258
Glass Transition Temperature (T_g)	A second order transition occurs in Kapton® between 360°C(680°F) and 410°C(770°F) and is assumed to be the glass transition temperature. Different measurement techniques produce different results within the above temperature range.		

Table 4
Electrical Properties of Kapton® HPP-ST Film at 23°C (73°F)

Property Film Gage	Typical Value		Test Condition	Test Method
Dielectric Strength	V/m kV/mm	(V/mil)	60 Hz 1/4 in electrodes 500 v/sec rise	ASTM D-149-91
25 µm (1 mil)	303	(7700)		
50 µm (2 mil)	240	(6100)		
75 µm (3 mil)	205	(5200)		
125 µm (5 mil)	154	(3900)		
Dielectric Constant			1 kHz	ASTM D-150-92
25 µm (1 mil)	3.4			
50 µm (2 mil)	3.4			
75 µm (3 mil)	3.5			
125 µm (5 mil)	3.5			
Dissipation Factor			1 kHz	ASTM D-150-92
25 µm (1 mil)	0.0018			
50 µm (2 mil)	0.0020			
75 µm (3 mil)	0.0020			
125 µm (5 mil)	0.0026			
Volume Resistivity	$\Omega \bullet cm$			ASTM D-257-91
25 µm (1 mil)	1.5×10^{17}			
50 µm (2 mil)	1.5×10^{17}			
75 µm (3 mil)	1.4×10^{17}			
125 µm (5 mil)	1.0×10^{17}			

Dimensional Stability

The dimensional stability of Kapton® polyimide film depends on two factors--the normal coefficient of thermal expansion and the residual stresses placed in the film during manufacture. The latter causes Kapton® to shrink on its first exposure to elevated temperatures as indicated in the bar graph in **Figure 1**. Once the film has been exposed, the normal values for the thermal coefficient of linear expansion as shown in **Table 5** can be expected.

Figure 1. Residual Shrinkage vs. Exposure Temperature and Thickness, Kapton® HN and HPP-ST Films

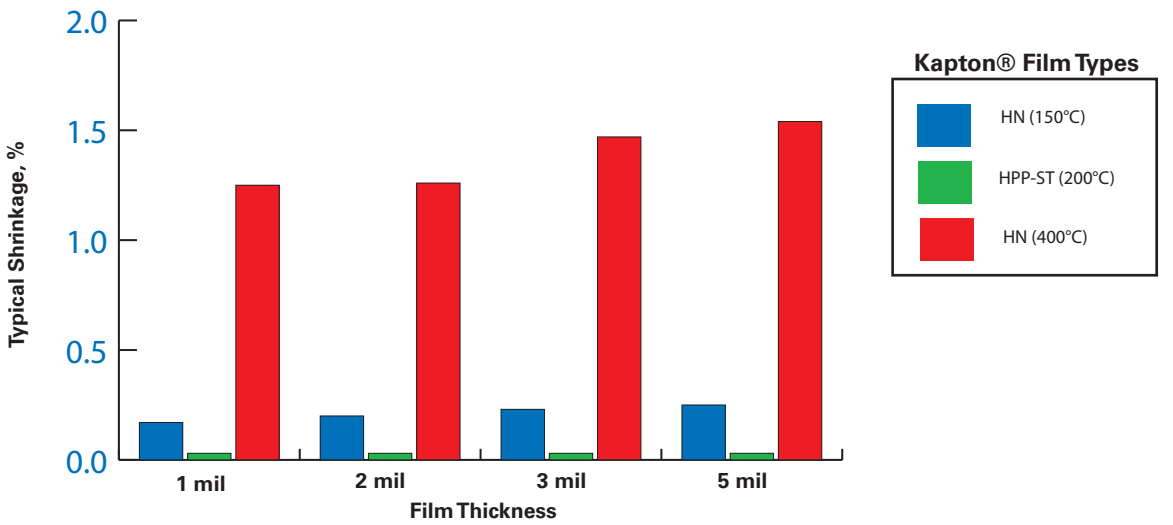

Table 5
Thermal Coefficient of Expansion, Kapton® HPP-ST Film, 25 µm (1 mil), Thermally Exposed

Temperature Range, °C, (°F)	ppm/°C
30-100 (86-212)	17
100-200 (212-392)	32
200-300 (392-572)	40
300-400 (572-752)	44
30-400 (86-752)	34

For more information on DuPont™ Kapton® or other High Performance Materials, please contact your local representative, or visit our website for additional regional contacts:

Americas
DuPont High Performance Materials
U.S. Rt. 23 & DuPont Road
Circleville, OH 43113
Tel: 800-967-5607

Europe
DuPont de Nemours (Luxembourg) S.A.R.L.
Rue General Patton
L-2984 Luxembourg
Tel: 352-3666-5935

Asia
DuPont Taiwan
No. 45, Hsing-Pont Road
Taoyuan, Taiwan, R.O.C.
Tel: 886-3-3773668

Japan
DuPont-Toray Co., Ltd.
5-6 Nihonbashi Honcho 1-chome
Chuo-ku, Tokyo 103-0023 Japan
Tel: 81-3-3245-5061

kapton.dupont.com

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