DuPont™ Kapton® HN

POLYIMIDE FILM

Technical Data Sheet

DuPont™ Kapton® HN general-purpose film has been used successfully in applications at temperatures as low as -269°C (-452°F) and as high as 400°C (752°F). HN film can be laminated, metallized, punched, formed or adhesive coated. Kapton® HN is the recommended choice for applications that require an all-polyimide film with an excellent balance of properties over a wide range of temperatures.

Applications

- Mechanical parts
- Electronic parts
- Electrical Insulation
- Pressure sensitive tape
- Fiber optics cable
- Insulation blankets
- Insulation tubing
- Automotive diaphragms sensors and manifolds
- Etching
- Shims

Product Specifications

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

Certification

Kapton® HN meets ASTM D-5213 (type 1, item A) and IPC 4202/1 requirements.

DUPONT®

The miracles of science™

Table 1
Physical Properties of Kapton® HN at 23°C (73°F)

Property	Unit	1 mil 25µm	2 mil 50µm	3 mil 75µm	5 mil 125µm	Test Method
Ultimate Tensile Strength at 23°C, (73°F) at 200°C (392°F)	psi (MPa)	33,500(231) 20,000(139)	33,500(231) 20,000(139)	33,500(231) 20,000(139)	33,500(231) 20,000(139)	ASTM D-882-91, Method A*
Ultimate Elongation at 23°C, (73°F) at 200°C (392°F)	%	72 83	82 83	82 83	82 83	ASTM D-882-91, Method A
Tensile Modulus at 23°C, (73°F) at 200°C (392°F)	psi (GPa)	370,000 (2.5) 290,000 (2.0)	370,000 (2.5) 290,000 (2.0)	370,000 (2.5) 290,000 (2.0)	370,000 (2.5) 290,000 (2.0)	ASTM D-882-91, Method A
Density	g/cc	1.42	1.42	1.42	1.42	ASTM D-1505-90
MIT Folding Endurance	cycles	285,000	55,000	6000	5,000	ASTM D-2176-89
Tear Strength-propagating (Elmendorf), N (lbf)		0.07 (0.02)	0.21 (0.02)	0.38 (0.02)	0.58 (0.02)	ASTM D-1922-89
Tear Strength, Initial (Graves), N (lbf)		7.2 (1.6)	16.3 (1.6)	26.3 (1.6)	46.9 (1.6)	ASTM D-1004-90
Yield Point at 3% at 23°C, (73°F) at 200°C (392°F)	MPa (psi)	69 (10,000) 41 (6000)	69 (10,000) 41 (6000)	69 (10,000) 41 (6000)	69 (10,000) 41 (6000)	ASTM D-882-91
Stress to produce 5% elong. at 23°C, (73°F) at 200°C (392°F)	MPa (psi)	90 (13,000) 61 (9000)	90 (13,000) 61 (9000)	90 (13,000) 61 (9000)	90 (13,000) 61 (9000)	ASTM D-882-92
Impact Strength at 23°C, (73°F)	N•cm•(ft lb)	78 (0.58)	78 (0.58)	78 (0.58)	78 (0.58)	DuPont Pneumatic Impact Test
Coefficient of Friction, kinetic (film-to-film)		0.48	0.48	0.48	0.48	ASTM D-1894-90
Coefficient of Friction, static (film-to-film)		0.63	0.63	0.63	0.63	ASTM D-1894-90
Refractive Index (sodium D line)		1.70	1.70	1.70	1.70	ASTM D-542-90
Poisson's Ratio		0.34	0.34	0.34	0.34	Avg. three samples, Elongated at 5, 7, 10%
Low temperature flex life		pass	pass	pass	pass	IPC-TM-650, Method 2.6.18

*Speciman size 25 x 150 mm (1.6 in); jaw separation 100 mm (4 in), jaw speed, 50mm/min (2 in/min). Ultimate refers to the tensile strength and elongation measured at break.

Table 2
Thermal Properties of Kapton® HN 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 $\frac{cal}{cm•sec•°C}$	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
Shrinkage, % 30 min at 150°C 120 min at 400°C	 0.17 1.25		IPC-TM-650 Method 2.2.4A; ASTM D-5214-91
Limiting Oxygen Index, %	37-45		ASTM D-2863-87
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 3
Typical Electrical Properties of Kapton® HN Film at 23°C (73°F), 50% RH

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

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 4** can be expected.

Figure 1. Residual Shrinkage vs. Exposure Temperature and Thickness, Kapton® HN and VN Films

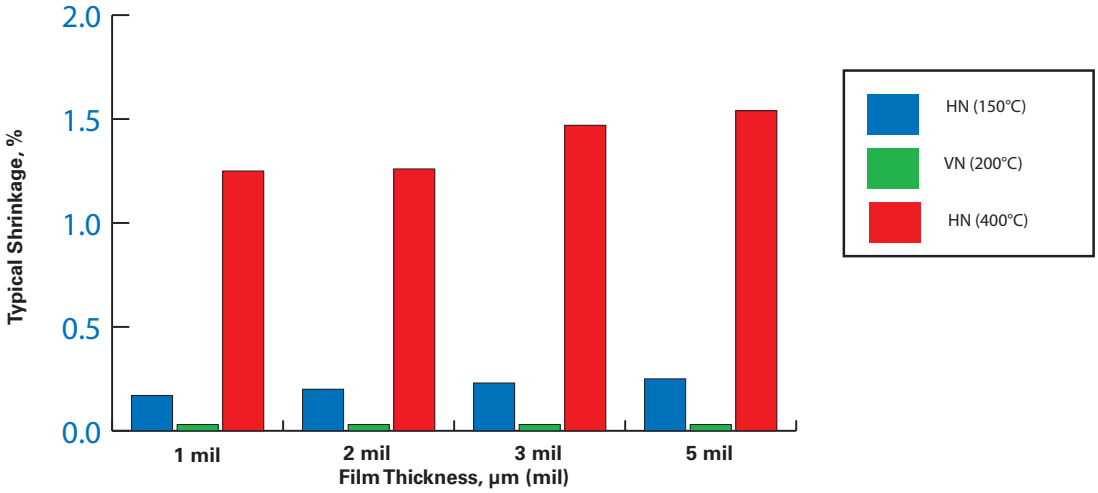

Table 4
Thermal Coefficient of Expansion, Kapton® HN Film, 25 µm (1 mil), Thermally Exposed

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

Copyright ©2006 DuPont or its affiliates. All rights reserved. The DuPont Oval, DuPont™, The miracles of science™ and Kapton® are registered trademarks or trademarks of E.I. du Pont de Nemours and Company or its affiliates.
NO PART OF THIS MATERIAL MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM OR TRANSMITTED IN ANY FORM OR BY ANY MEANS ELECTRONIC, MECHANICAL, PHOTOCOPYING, RECORDING OR OTHERWISE WITHOUT THE PRIOR WRITTEN PERMISSION OF DUPONT.
Caution: Do not use in medical applications involving permanent implantation in the human body, or contact with internal body fluids or tissues. For other medical applications, see "DuPont Medical Caution Statement," H-50102.

This information is based on data believed to be reliable, but DuPont makes no warranties, express or implied, as to its accuracy and assumes no liability arising out of its use. The data listed herein falls within the normal range of product properties but should not be used to establish specification limits or used alone as the basis of design. Because DuPont cannot anticipate or control the many different conditions under which this information and/or product may be used, it does not guarantee the usefulness of the information or the suitability of its products in any given application. Users should conduct their own tests to determine the appropriateness of the product for their particular purposes.

DUPONT®
The miracles of science™

K-15345 03/06