

DuPont™ Tedlar®

polyvinyl fluoride film

Technical Information

Release Films for Printed Circuit Laminate Manufacture and Multilayer PC Boards

Description

DuPont™ Tedlar® polyvinyl fluoride films are the release materials of choice for the processing of epoxy-based printed circuit substrates. The high tensile and tear strengths, inertness, thermal stability, and nonstick properties of Tedlar® combine to make an excellent release film for FR-4 laminate and multilayer board production. Because of its unique blend of properties, Tedlar® is also frequently selected as the desired release material for many other rigid and flexible printed circuit substrates. Tedlar® films are available in nominal thicknesses of 25 and 51 µm (1.0 and 2.0 mil), clear or translucent, and in several surface finishes.

Applications and Film Types

From the broad family of DuPont™ Tedlar® PVF films, a variety have been specially formulated to serve the needs of the printed wiring board industry. Whether the application is laminate production or multilayer fabrication, Tedlar® films provide outstanding release from phenolic, acrylic, and epoxy resins, as well as from copper, oxide, and standard press plate surfaces, either hot or cold. Table 1 details the typical applications for which Tedlar® PVF release films have been designed.

Table 1
DuPont™ Tedlar® PVF Release Films

Tedlar® Type	Application			
	FR-4 Epoxy Laminate	FR-4 Rigid Multilayer	Flexible Multilayer	Rigid-Flex Multilayer
TPC10SM3	X	X		
TMR10SM3	X	X		
TTR10SG3			X	
TTR20SG4			X	X
TMR20SM3	X	X	X	X

All Tedlar® printed circuit release products are designed to minimize plate scumming and to withstand normal epoxy, acrylic, and phenolic curing conditions without embrittlement or charring. Specific requests for release films with enhanced properties often can be accommodated with customized Tedlar® films. See **Table 3** for a breakdown of the Tedlar® film codes for ordering purposes.

Mass Lamination/Rigid Multilayers Tedlar® TMR10SM3

This film is the standard product recommended for the manufacture of FR-4 epoxy laminate. Of the Tedlar® printed circuit release films, this product imparts the greatest surface roughness to the epoxy surface during processing. The resulting transfer of this texture to the resin surface enhances the adhesion of additive processing chemistries, legend inks, protective masks, and additional layers of resin or prepreg to the laminate. Furthermore, TMR10SM3 has been designed for laminate manufacturers who use operating temperatures as high as 188–193°C (370–380°F), or processing cycles longer than two hours to obtain the highest epoxy Tg (glass transition temperature) possible without compromising production efficiency or quality. Also, this film can be used for the manufacture of FR-4 rigid multilayer boards when broader operating parameters are desired. In addition to processing flexibility, it can be used to impart a controlled texture onto the multilayer board copper surface, which may be desirable for surface mount work or improved resist adhesion.



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DuPont™ Tedlar® TPC10SM3

This is a widely used printed circuit release product for the manufacture of FR-4 epoxy multilayer boards. Besides ease of release, it offers high tensile strength and superior tear resistance, making it the most functional and efficient release film for multilayer processing. In addition, TPC10SM3 provides an excellent cushion, minimizing pitting and denting of the laminate surface from foreign materials during processing. Laminate manufacturers have found this film to be an excellent release film for FR-4 epoxy laminate when high temperatures, long processing cycles, and an extremely textured laminate surface are not required.

Flexible/Rigid-Flex Multilayers Tedlar® TTR20SG4 and TMR20SM3

These release films are frequently used in the manufacture of flexible or rigid-flex printed wiring boards due to their conformal properties, toughness, and inertness to bonding adhesives. In addition, TMR20SM3 is recommended for flexible or rigid-flex applications that require a broader operating range.

Tedlar® TTR10SG3

This film has been designed specifically for flexible or rigid-flex processes that utilize lower circuit heights.

Product Construction and Properties

Tedlar® PVF films are homogeneous products. The polyvinyl fluoride release material, carrier, binder, texturizing pigments, and any special additives are thoroughly combined and matrixed. Therefore, no texturizing coatings or release agents are applied to the surface of the film. This avoids potential sources of contamination to the pressed laminate or multilayer board. Their uniform composition means that handling, cutting, or tooling of Tedlar® films will not expose any inner layers of non-release material that could cause sticking and subsequent breakdown problems. Tedlar® contains absolutely no silicones, which are a potential source of board delamination, resist lifting, and chemical bath contamination.

The polyvinyl fluoride binder used in Tedlar® films is inherently flexible and strong. Therefore, the film contains no plasticizers or reinforcing agents that could leach out during storage or processing, causing embrittlement or weakening of the film. This enables Tedlar® film release products to retain their properties throughout processing or for extended storage periods.

Because the surface roughness of Tedlar® film is achieved by the addition of hard pigments rather than surface embossing, transfer of the film texture to the curing epoxy is quite efficient. This gives Tedlar® films the capability of providing the high degree of matte finish to cured epoxy laminates that is desired by most laminators and their customers. The polyvinyl fluoride binder is soft enough to absorb many types of particulate contaminants and minimize their potential for damaging the laminate surface.

Finally, Tedlar® release films do not support combustion, an important safety feature often overlooked when choosing a release material.

Table 2 details key physical properties for the most commonly used films.

Product Use Considerations

Static

Static charges can accumulate in the unwinding, sheeting, or handling operations of thin polymeric based films. Static discharge across the surface of most polymeric films can render them susceptible to sticking in those areas. In extreme cases, it may be necessary to add grounding and commercial static elimination devices to the handling equipment to control static buildup.

Thermal Degradation

The thermal stability limit of Tedlar® PVF films is a function of both time and temperature. When the combination of the two exceed the capabilities of the film, thermal degradation will occur. This degradation is characterized by embrittlement, browning, and then charring of the film. If press plates become contaminated with charred Tedlar®, repeated use of the plates can cause premature charring of fresh film. The plates should be thoroughly cleaned and rinsed with a dilute water solution of sodium carbonate or sodium bicarbonate. Acidic conditions, such as the use of boron fluoride type complex catalysts or high levels of plating and etching residues, can initiate premature film degradation resulting in possible sticking or charring.

Typically, thermal degradation of Tedlar® film proceeds quite rapidly above 204°C (400°F). Therefore, it is of limited value for release applications involving the cure of polyimide resin systems. Tedlar® film may be used during the initial step (193°C [380°F] or lower) of two-stage polyimide curing processes normally employed with steam or hot-water-heated lamination equipment. However, the release film must be removed prior to post-baking above 193°C (380°F).

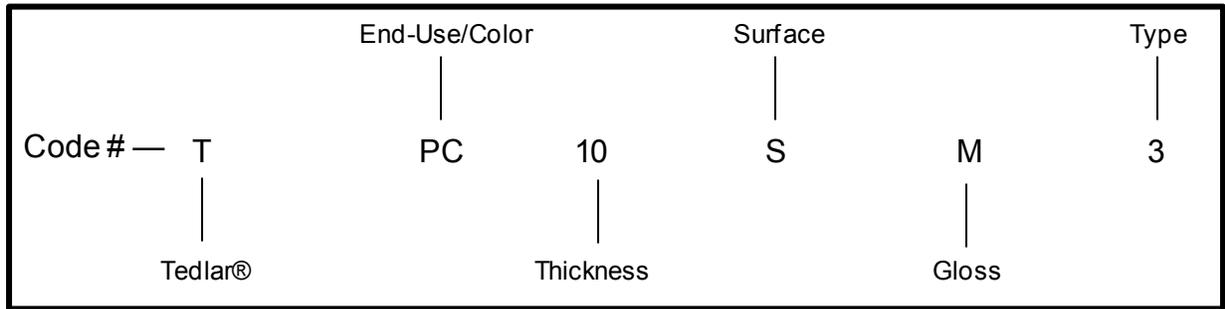
Disposal

The preferred option for disposal is landfill. Incinerate only if incinerator is capable of scrubbing out hydrogen fluoride and other acidic combustion products. Treatment, storage, transportation, and disposal must be in accordance with applicable federal, state/provincial, and local regulations.

Table 2
DuPont™ Tedlar® PVF Release Film Descriptions and Typical Properties

Property	TMR10SM3	TPC10SM3	TTR10SG3	TMR20SM3	TTR20SG4
Nominal Thickness, μm (mil)	25 (1)	25 (1)	25 (1)	51 (2)	51 (2)
Color	Translucent	Translucent	Clear	Translucent	Clear
Surface Roughness μm (μin)	0.76 (30)	0.51 (20)	0.18 (7)	0.76 (30)	0.25 (10)
Tensile Strength, kpsi					
MD	12	12	16	13	13
TD	14	14	19	15	19
Elongation, %					
MD	115	125	120	130	150
TD	100	105	110	110	125
Initial Tear Resistance, lb/mil	1	1	1	1	1
Approximate Yield, m ² /kg (ft ² /lb)	28.3 (140)	28.3 (140)	28.3 (140)	14.1 (70)	14.1 (70)

Table 3
DuPont™ Tedlar® Film Codes



KEY:

END USE/COLOR

- TR**—Transparent
- PC**—Epoxy Board Release
- MR**—High Temperature Release

NOMINAL THICKNESS

- 10**—1 mil
- 20**—2 mil

SURFACE

- S**—Release
- A, B**—Adherable (should not be used for release applications)

GLOSS

- G**—Glossy
- M**—Matte

TYPE

- 3**—Medium Tensile and Elongation
- 4**—High Elongation, Good Conformal Properties

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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.

CAUTION: Tedlar® is not approved for use in ultralight aircraft wings.

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