



WHITE PAPER



Traditional Thinking about Pressure-Sensitive Film is Changing



Change; sometimes it is gradual and other times it happens seemingly overnight.

Exhibit one is the economy. The key is finding the leading indicator and preparing yourself for that change. In every challenge, there is opportunity.

In the electronics industry especially, the pace of change is accelerating. The half-life of today's electronics products is quite fleeting. No sooner do design cycles end and production engineers draw up and tool up to meet the demand for the latest smart phone, barcode scanner or laptop computer, than they find themselves redrawing and retooling to leverage the technology needed to create the next electronic miracle. Fast change requires fast thinking – and even faster action – if a company wants to benefit from new advancements before they become yesterday's news. That means products have a shrinking window of opportunity to go from design to market.

Anything that can help design engineers harness new technology, get a high-quality product to market faster, improve product security, and keep total applied costs down offers a crucial advantage. One way to ensure success in such a dynamic environment would be to insist on using a supplier with the flexibility to adjust to the manufacturer's needs for customized or standard components that optimize investment return whether it's used in short or long production runs.

Pressure-Sensitive Film: Not Just for Labels Anymore

To keep up with the dynamic nature of accelerated change in the electronics industry, product design engineers are becoming more technologically vigilant – their design and production processes, more agile and adaptable. But also driving their efforts, are the rigorous mandates set forth in the Statement of Objectives (SOO) / design specifications put out by OEMs today. They typically require tight adherence to specific parameters in order to:

- Reduce the total applied cost of the product
- Reduce product design cycle time
- Ensure product traceability and complete product security (overt, covert and forensic)
- Ensure the product has 2D/IUID data matrix marking for the life of the product

To meet these strict requirements, design engineers are resourcefully finding new solutions – and novel uses for existing solutions. For instance, let's look at pressure-sensitive film. Chances are most electronics design engineers regard pressure-sensitive film as a material that, by and large, is limited in use to warning, identification, instructional, circuit board, and battery and brand labels. That's not to say labels are unimportant in product design. They are. To be sure, as the electronic product evolution progresses, devices are sporting finished surfaces composed of entirely new materials, to which labels must adhere for the life of the product. These products are becoming more compact, so labels are given a shrinking share of real estate to do their appointed jobs. Electronics are also running hotter; labels have to stand up to this. Plus, at any one time, electronic devices can be found anywhere from pants pockets, to hot automobile interiors, to half-way up Mount Everest, to oil-entrained industrial environments. There are pressure-sensitive films for all of these labeling uses and more.

What's interesting is that design engineers are discovering new uses for pressure-sensitive film in electronics products that go beyond labeling applications. For example, films and adhesives can be used



for fastening components, damping noise and vibration in high-speed rotational devices and cushioning and other critical functions. And it is doing this in a way that allows design engineers to comply with the OEM's Statement of Objectives, while keeping pace with – or even outpacing – the speed of technological change in the electronics industry.

To understand how, let's take a closer look at today's pressure-sensitive film technology.

The Pressure-Sensitive Film "Sandwich"



Pressure-Sensitive Film: The Film

The flexible nature of pressure-sensitive film – both literally and figuratively – gives design engineers limitless possibilities in meeting electronic product development requirements. In many cases, the wide-ranging characteristics and potential of pressure-sensitive film can be the catalyst for new product designs.

The reason is that it is comprised of four layers of widely varying material components – film, adhesive, topcoat and liner – that can be infinitely combined to best meet the electronic application need.

By combining various component layers, design engineers can specify a pressure-sensitive film to suit a wide range of electronic product applications.

The success with which product engineers can use pressure-sensitive film to match, say, the gloss level of an LCD display, the grain pattern of walnut, or the texture of brushed nickel, is a function of the film's facestock – or film layer. There is a seemingly endless array of colors, gloss intensities and finishes available for the film layer to match or enhance the look of virtually any application. Yet the facestock options also go beyond aesthetics. Its material composition, for example, is key to providing necessary durability characteristics to the pressure-sensitive film solution. Film gauges and thicknesses can play an important role here – they can range anywhere from .5 mil to 10 mil. Depending on the electronic product application, the film layer material options can be:

- Vinyl (either rigid or flexible)
- Acrylic Acetate
- Polyethylene
- Polystyrene
- Polyethylene Naphthalate (PEN)
- Tedlar[®]
- Tyvek[®]

- Polyester
- Polycarbonate
- Polypropylene
- Diacetate
- Kapton[®]
- Teslin[®]

* Note: Tedlar®, Kapton® and Tyvek® are registered trademarks of the E.I. DuPont Company and Teslin® is a registered trademark of PPG Industries.



Pressure-Sensitive Film: The Adhesive

The adhesive layer of the pressure-sensitive film is a functional component of the label. It is a liquid substance that, when pressure is applied, enables the label to adhere permanently to the application surface. The product surface, in addition to the environmental conditions the adhesive is likely to encounter, will largely dictate what the adhesive properties should be. These properties are characterized in terms of tack, peel and shear, as well as other attributes such as resistance to chemicals, UV radiation, heat, humidity and other environmental conditions. The ability of a label to stay adhered to a battery during manufacturing is one example of where this adhesive layer is key in the electronics industry.

Pressure-Sensitive Film: The Topcoat

The number one job of the topcoat layer of pressure-sensitive film is to ensure proper ink adhesion to the surface of the film. Therefore, depending on the application, topcoats need to be compatible with a range of conventional, UV and water-based inks, as well as printing methods, such as screen printing, flexographic, letterpress and offset printing as well as variable methods including laser printing, thermal transfer, impact, inkjet, and electron beam.

Pressure-Sensitive Film: The Release Liner

Liners serve a functional process as a base to die-cut against, as well as serve as the support material to assist in the manufacturing process. Liners are typically viewed as the "throw away portion," however attention should not be overlooked on what liner to chose.

An example of the liner as a critical component of the solution is in the hard drive industry. A simple liner would leave finite strands of material as a residue in the dispensing process. This would be catastrophic to the hard drive operation.

Another concern is that during laser printing the actual printer can be damaged due to the thickness and heat resistance of the liner.

Release liners, whether in sheet form or roll form, need to withstand the printing, diecutting, lamination and application steps inherent in the converting industry as well as in the various electronic product testing and manufacturing processes.

Get Pressure-Sensitive Film Involved in Product Design Early

What's most beneficial about the pressure-sensitive film "sandwich" is that you can have it your way. Just as design engineers should consider pressure-sensitive film a key label component at the very outset of the product development process, it is perhaps even more important to get pressure-sensitive film into the design discussion when the end product calls for components that need to provide traceability, surface protection, fastening capability, noise damping, cushioning and security. Pressure-sensitive solutions can fulfill many of these critical requirements, whether the electronic product being developed is for the home, mobile communication, enterprise or government use.



The right combination of film, topcoat, adhesive and liner can be formulated to minimize total applied cost and get the product to market as quickly as possible. Home electronic devices from televisions to computer disk drives, for example, can be designed with the right combination of film layers to create components that eliminate noise and vibration. Mobile electronics such as cell phones and PDAs can benefit from pressure-sensitive film that will provide cushioning to enhance impact resistance. Enterprise related electronic products from RFID tags can effectively harness the variable thicknesses of pressure-sensitive film, while GPS devices can benefit from the conductivity properties of the film. Also, state and federal governments now depend on the flexibility of pressure-sensitive film for security applications – especially where transportation and identification documents are concerned.

Pressure-Sensitive Film: Anatomy of a Cell Phone

The cell phone design engineers and product managers employ three innovative uses for pressure sensitive films. Product aesthetics is one. In this case, the film is used as both a product branding statement for brand awareness, and as a protective membrane to keep the product from scratches and blemishes during transportation and handling. This is also the film that shows whether an electronic



product has been used or damaged when the end user removes it from the package.

Another area depicted in the diagram is the flexible electronics capability of the pressure-sensitive film. The wiring of the platforms inside the unit is key to the operations of the cell phone. The ability to maintain this reliable connection is key to operation. A pressure-sensitive film makes the connection. Also, battery labeling can provide sub unit protection and stability that allows the cell phone to maintain its utility and availability.

There are many representative ways that pressure-sensitive film can be applied in electronic product design outside the sphere of labeling. A proven application of pressure sensitive solutions is to provide noise damping in electronics. Many hard drive manufacturers, for example, turn to pressure sensitive films to provide noise damping capabilities to their product lines to reduce noise output to the end user environment.



The other area for pressure-sensitive film that is new is the ability to create simple solutions for sometimes very complex problems. When the RFID tag on a metal container did not perform to specification (the RFID tag was to replace a bar code label), the last thing a design engineer thought of was to use pressure sensitive film. But the team eventually discovered that a foam-layered PSF gave the RFID tag the ability to protrude out from the metal container and create a ground plane for the tag to reflect the RF energy off the container. After mounting the tag to the container with the right pressure-sensitive film sandwich the RFID tag exceeded specifications.

Pressure-Sensitive Film: Ensuring Product Security, Authenticity and Consumer Protection

Security, as it pertains to electronics products generally centers around the protection of company profits and ensuring customer safety. Security requirements can be classified as overt, covert and forensic (traceability).

Product security strategy in the overt sense might take the form of a label that is holographic in nature. For instance, the popular "Intel Inside" label found on some computers is very visible confirmation of the product's authenticity, and it is designed so the consumer can clearly see it. If it is expected, but not there, both the manufacturer and consumer lose.

An example of product covert security strategy can include the ability to have a label turn a certain color or otherwise change its appearance when it encounters a set of conditions that would knowingly cause the change. The actual label change is undetectable to the human eye, but under the appropriate detection

equipment it becomes clear that the product is a counterfeit or has been damaged. This then gives the warranty provider and manufacturer legal grounds to void the warranty and reduce product lifecycle costs.

The third example of product security is product traceability, which is part of the electronic product manufacturer's forensic strategy. A verifiably unique label identifying each contract manufacturer can, for example, help a forensic analysis team in the event of a product failure. This gives the product manager or owner the ability to understand what has happened and then evaluate or otherwise limit liability for any negative financial impact.



Low Authenticity Value to Customer Base

FIGURE 3: The Security Solution Value Balance

Security solution employed must be in balance and achieve closer proximity to the desired state.



The product security application of an overt, covert, or forensic method must be balanced with the product security attribute.

For instance, the authenticity value of audio CDs and designer jeans is not a big issue with consumers, but is critical to the brand integrity of the provider. On the other hand, products such as MRI systems and electronic airplane parts are of crucial value to both the consumer and the manufacturer. Developing the right pressure sensitive film to support and convey the desired authenticity state is key to the early design and long-term security and profitability of the product.

Pressure-Sensitive Film: As Critical as any Other Electronic Product Component

Traditional mindsets regarding pressure-sensitive film are changing as new technologies create opportunities in today's home, mobile, governmental, and enterprise electronics product markets. The solution set seems limitless with advances in polymers and chemistry, combined with the creative minds in the pressure-sensitive film industry. The right film supplier can ensure the long term performance demanded by electronic product consumers, while enabling designers to get their product to market quicker and at the lowest total applied cost, as long as the film is specified early and as an integral part of the product as a whole.



About the Author

Ken Koldan joined FLEXcon in April 2008. He focuses on providing FLEXcon's expertise and product solutions to design engineers and economic buyers within the Consumer Electronics, HVAC, Security, and Appliance markets.

Ken was previously at a Fortune 100 corporation where he served as Director of Business Development and gained extensive experience in strategic planning and

new market development. Throughout his career, Ken has held a variety of roles, including Engineering Manager, Program Manager, and Systems Engineer. He has worked in various industries ranging from Theoretical Physics to Banking and most recently in Mission Critical Wireless Communications.

Ken holds an MBA from Keller Graduate School of Management at DeVry University and a Bachelor of Science degree in Electrical Engineering from the University of Illinois. He also holds Project Management Professional (PMP) certification from the Project Management Institute.

About FLEXcon

FLEXcon is an innovator in adhesive coating, laminating and finishing of durable materials used in graphics applications, electronics and new products. Through a culture of curiosity, flexibility and a drive for excellence, FLEXcon is the trusted partner to a wide range of companies from printers and fabricators to engineers and designers developing products for existing and emerging markets. Headquartered in Spencer, MA, the company has operations throughout North America and Europe with distribution worldwide.



Let's Talk Solutions

Bring your challenges or next big idea to FLEXcon and we will work together to find a solution. Call us at +1 (508) 885-8200 or visit our website at www.FLEXcon.com.

Corporate Headquarters

1 FLEXcon Industrial Park Spencer, MA 01562-2642 USA Telephone +1 (508) 885-8200 FAX +1 (508) 885-8400 www.FLEXcon.com

Performance Products Business Team Telephone +1 (508) 885-8440 FAX +1 (508) 885-8355

Product Branding Business Team Telephone +1 (508) 885-8370 FAX +1 (508) 885-8399

Product Identification Business Team Telephone +1 (508) 885-8300 FAX +1 (508) 885-8301

Manufacturing, Distribution & Sales Centers

North America

 FLEXcon Spencer, Massachusetts

 1 FLEXcon Industrial Park

 Spencer, MA 01562-2642 USA

 Telephone +1 (508) 885-8200

 FAX +1 (508) 885-8400

 FLEXexpress FAX: +1 (800) 428-4505

FLEX.con Columbus, Nebraska 2021 E. 23rd Street Columbus, NE 68601 USA Telephone +1 (402) 562-6131 FAX +1 (402) 562-6054

Europe

FLEXcon Europe Ltd. Whitworth Road Southfield Industrial Estate Glenrothes, Fife KY6 2TF Scotland - UK Telephone +44(0) 1592 663200 FAX +44(0) 1592 663201 europeinfo@FLEXcon.com

Sales Offices

North America

FLEXcon Pennsylvania Routes 1 & 202 The Weichert Building, Suite 260 P.O. Box 156 Chadds Ford, PA 19317 USA Telephone +1 (610) 358-2571 FAX +1 (610) 358-5946

FLEXcon Kansas 1305 South Fountain Drive Olathe, KS 66061 USA Telephone +1 (913) 768-8669 FAX +1 (913) 894-5129 FLEXexpress FAX: +1 (800) 732-4329

Latin America

Convertidor Flexible Express, S. de R.L. de C.V. Prol. Reforma, #1190 Torre B, Mezzanine Oficina #314. Col Cruz Manca Santa Fe, 05349, Mexico, D.F. Mexico Telephone +1 52 (55) 5290-8286 / +1 52 (55) 5292-8886 FAX +1 52 (55) 5290-8286



Distribution & Sales Facilities

North America

FLEXcon California

12840 Reservoir Street Chino, CA 91710-2952 USA Telephone +1 (909) 465-0408 FAX +1 (909) 627-4136 FLEXexpress FAX: +1 (800) 446-4136

FLEXcon Ontario

1020 Lorimar Drive Mississauga, Ontario L5S IR8 Canada Telephone +1 (905) 795-5509 FAX +1 (905) 795-8984 FLEXexpress FAX: +1 (800) 563-9143

Europe

FLEXcon Europe Ltd. Flevolaan 3 1382 JX WEESP P.O. Box 131 1380 AC WEESP The Netherlands Telephone +31 294 491 800 FAX +31 294 430 887 europeinfo@FLEXcon.com

Asia Pacific

FLEXcon Asia Ltd. G/F Sun King Industrial Building 1-7 Shing Chuen Road Tai Wai, NT Hong Kong, SAR Telephone +852 2350 2100 jyu@FLEXcon.com

FLEXcon Converting, Inc., Shanghai

The Center 989 Changle Road Suite 2011 Shanghai 200031 China Telephone +852 2350 2100 cchen@FLEXcon.com

FLEXcon Converting, Inc., Singapore Sales Office

Telephone +65 6513 0557 nchai@FLEXcon.com

Africa and Middle East

FLEXcon International Sales Office 1 FLEXcon Industrial Park Spencer, MA 01562-2642 USA Telephone +1 (508) 885-8223 FAX +1 (508) 885-8355