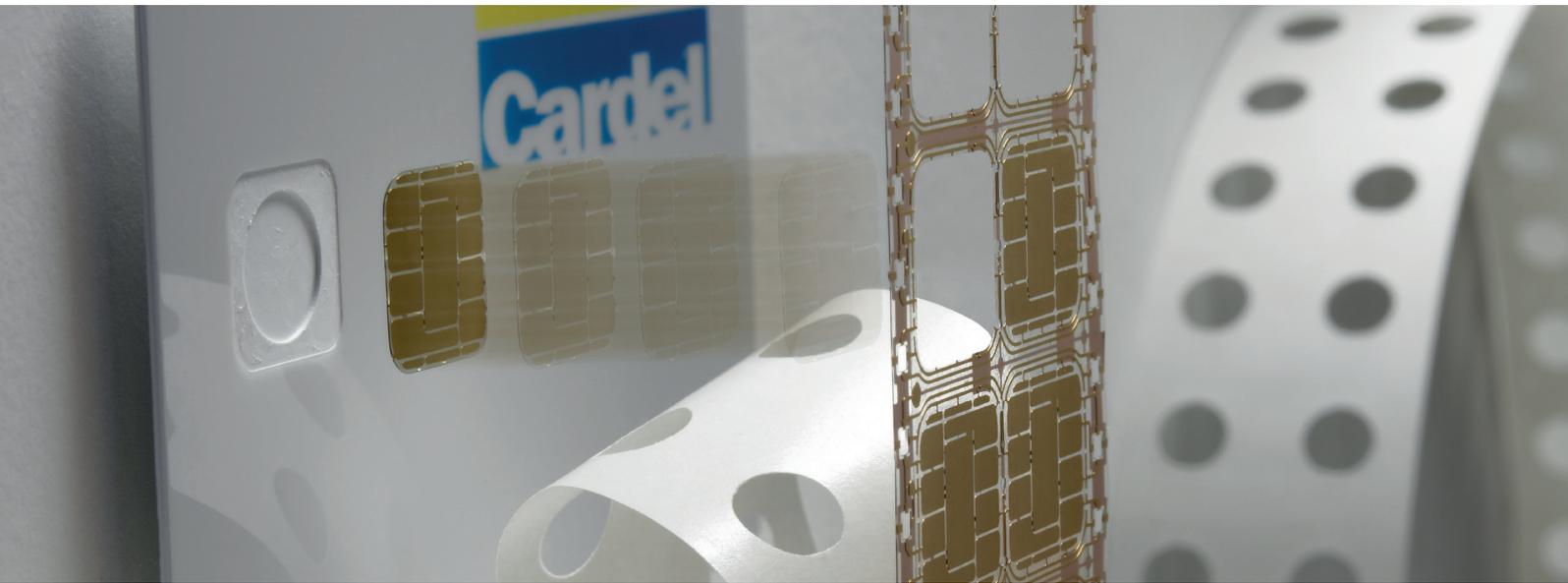


Hi-Bond™



The Cardel HiBond™ range of high performance micro module adhesives for Smart Card embedding. A unique range of dry film/heat activated adhesives specifically developed to meet the demands of bonding modern micro-moduled chips into a range of card materials.

As the sophistication and size of microchips implanted in smartcards increases, the “micro-modules” which package the chips have adopted a rigid structure to resist the typical bending stresses during a smartcard lifecycle that could damage the encased silicone.

At the same time banks and other card issuers have been encouraged to extend the period between reissue of smartcards for economic and environmental reasons and the active life of these cards is now longer than ever.

Modern implantation therefore often involves bonding a rigid micro-module into a flexible card body and maintaining a secure bond between the two for several years.

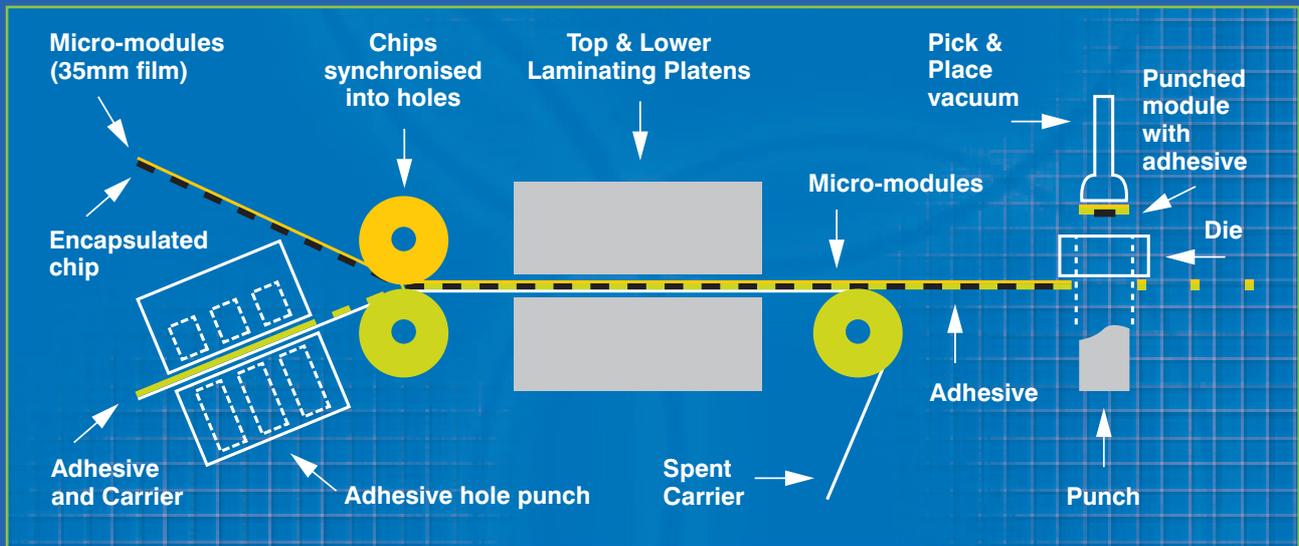
The variety of card materials has also increased to offer additional durability and lifetime and to satisfy environmental concerns. Usage of Polyesters and Polycarbonate is increasing together with traditional PVC and ABS.

The adhesive used to bond micro-modules into smartcards is therefore a key component in achieving the security and durability of the final card. The adhesive must provide a high performance bond over a wide variety of materials ensuring the card will withstand the intended lifecycle with full functionality.

The Hi-Bond™ range has been formulated specifically to provide a high performance bond of micro-modules into card that will withstand the rigours of both mechanical and environmental stresses over a number of years. It has been used widely since the 1990s for applications in microprocessor GSM and banking cards and is established as the preferred choice in many of the world's leading smartcard producers.

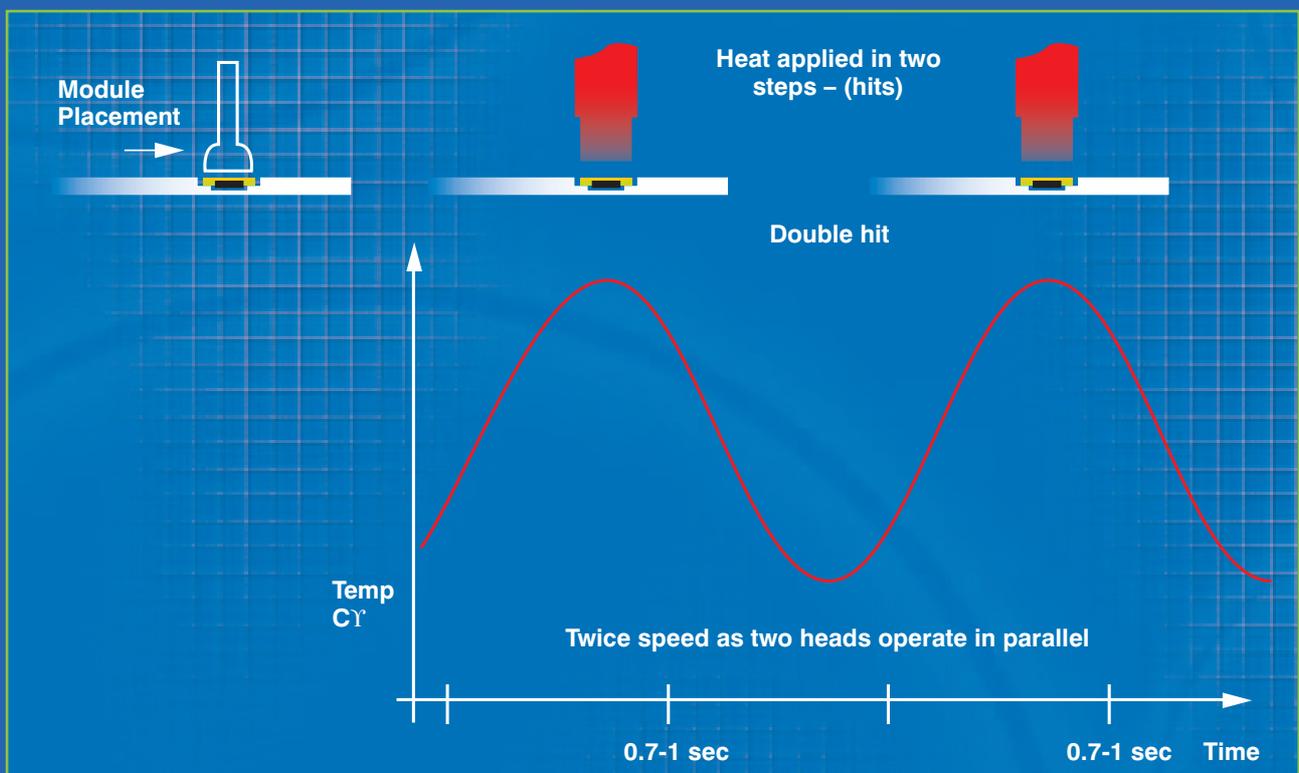
The HiBond™ adhesive tape process

Hi-Bond™ adhesive tape is a heat reactive "dry film" process providing a convenient controllable means of implanting micro-modules in ISO cards with high speed, precise process control and consistent results. The use of the adhesive is in two principal steps:



1 – Adhesive lamination and Micro-module punching

The adhesive has holes punched to accommodate the chip and is then laminated to the reverse of the micro-modules which are normally in 35mm film format. Each micro-module is punched out with the adhesive laminated to the underside – this gives a uniform amount of adhesive "size for size" on the back of the module. This is then placed into a precisely milled cavity or "pocket" within the card.



2 – Micro-module implantation

The adhesive is activated by heated heads which contact the module face and transfer heat through to melt the adhesive on the reverse creating the bond. The area under the curve represents the heat input into the adhesive by the heated heads – two heads increases productivity and splitting the activation into two steps spreads the heat input and reduces peak temperatures of the process. This reduces residual heat to the back of the card while achieving the same bond result. The time/temperature curve can be easily and precisely adjusted giving exact control over the process and the ability to adjust set-up for a variety of modules and card material specifications. Hi-Bond™ can be processed between 170 and 190 degrees centigrade by adjustment of the time/temperature curve.

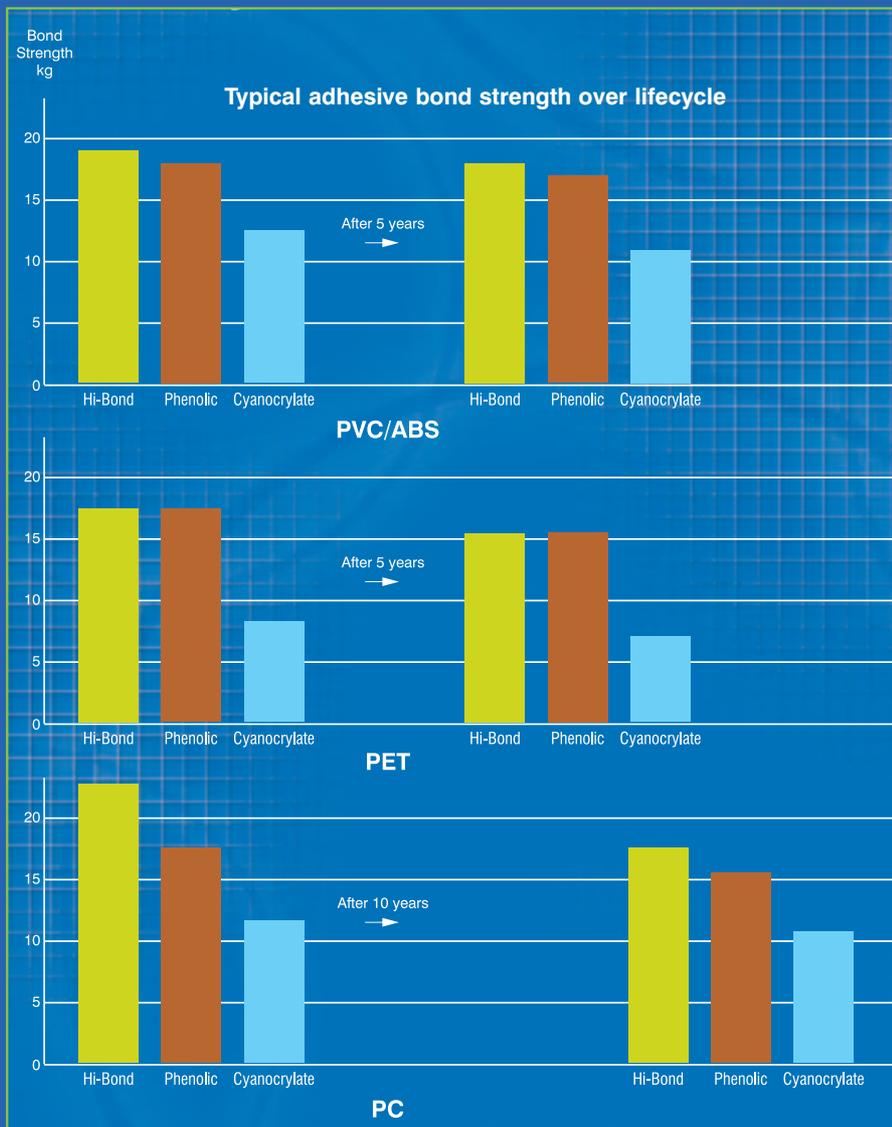
HiBond™ general features

- Optimum bond strengths (for PVC, ABS and blends polyesters and polycarbonate).
- Rapid reaction speed enabling high throughput.
- Fabricated as a translucent film to minimize shadowing on the back of the cards.
- High resistance to plasticiser migration.
- Up to two years' shelf life.
- Fully compatible with all major micro-module implantation machines.

The Hi-Bond™ range

Reference	Application
Hi-Bond™ 3	The worlds most commonly used adhesive for embedding chips into Banking cards (1 in 3 cards globally)
Hi-Bond™ 2	Primarily used in the embedding of SIM cards (GSM) for the Telephony industry
Hi-Bond™ 70-1	For use with FR4 and FCOS™ modules in PVC, ABS, PETG and PC cards
Hi-Bond™ B (Black)	Specialist version of Hi-Bond 70-1 with laser protective properties for embedding of SIM cards (GSM). Protects against laser burn through damage in laser personalisation (see below*)

Security



Productivity

Typical bonding times are 0.8 – 0.9 seconds for a two-heat station implantation machine providing speeds in excess of 4,000 cards per hour depending on machine and model.

Durability

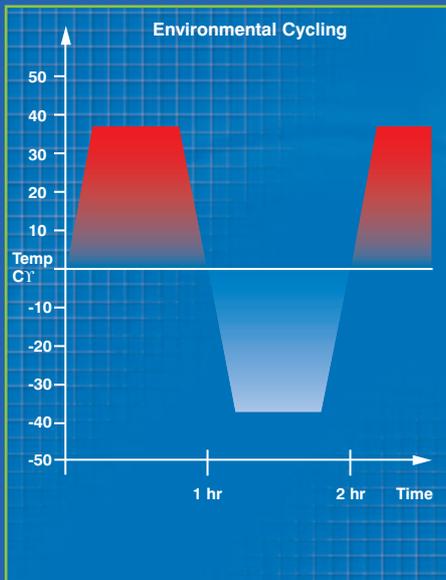
Hi-Bond™ has proven durability in the field under a variety of applications and conditions. Typically being applied in cards with three-year lifecycles and used in cards with up to ten years (PC).

Durability

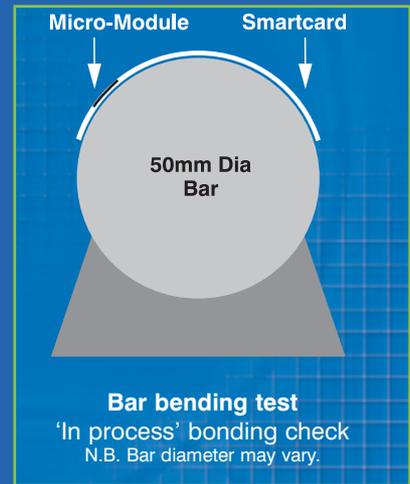
Hi-Bond™ has proven durability in the field under a variety of applications and conditions. Typically being applied in cards with three-year lifecycles and used in cards with up to ten years (PC).

* Hi-Bond B (Black)

Cardel developed a unique Hi-Bond variant in response to an industry problem of "burn through" of laser engraving to the reverse of the chip module in SIM cards (GSM). Our HB-B (Black) version of Hi-Bond absorbs and dissipates any laser energy to protect the chip module in the event that the laser engraving during personalisation penetrates the PVC. This development saves Cardels customers the considerable cost of loss of yield and inconvenience that is caused by this issue.



Actual life-cycle performance – the assurance of quality. A number of ISO and other tests have been devised to establish the performance and durability of adhesives to bond micromodules into cards. These tests aim to simulate conditions cards will experience during their lifecycle and include for example environmental accelerated ageing. However they cannot replace the reality of a smartcard lifecycle under the variety of applications and conditions experienced around the world over an extended period. of time. Hi-Bond™ passes and exceeds the laboratory tests but more importantly has been used in hundreds of millions of microprocessor smartcards in a range of conditions in over thirty countries over the last five years. It is this proven performance in



the real lifecycle of modern smartcards in large volumes that provides assurance of quality. This is combined with a continuous programme of development to ensure the Hi-Bond™ range continues to be a leading choice of smartcard implantation adhesives.

Suitability table

Hi Bond reference	Card material					
	PVC	ABS	PETG	PC	SIM	
Hi-Bond™ 3	✓	✓	•	•	•	
Hi-Bond™ 70-1	✓	✓	✓	✓	•	
Hi-Bond™ 2	✓	•	•	•	✓	
Hi-Bond™ B (Black)	✓	✓	✓	✓	✓	

- ✓ Exceeds ISO and internationally recognized standards for bonding strength, mechanical and environmental performance
- Not suitable

Specification

	Hi-Bond™ 3	Hi-Bond™ 2	Hi-Bond™ 70-1	Hi-Bond™ B (Black)
Machine Setting	180° – 200°C	180° - 210°C	160° – 190°C	170° – 200° C
Av. adh. wt.	40gsm	35gsm	40gsm	45gsm
Width	25-30mm	25-50mm	25-30mm	25-50mm
Length	100/200m	100 – 400m	100/200m	100 – 400m
Carrier (siliconised)	90gsm	90gsm	90gsm	90gsm
Core	3" spiral core	3" core	3" spiral core	3" core
Storage	30° – 50°C	30° – 50°C	30° – 50°C	30° – 50°C
Shelf life	2 years (under recommended storage conditions)			

Compatible with all major smartcard production machines including Muhlbauer, Cybernetix, Datacard (Gilles Leroux), Ruhlatmat. Contact Cardel for guideline settings and technical advice on set-up.

Cardel Products are used daily throughout the global card industry and are produced to the highest standards for application in card production.