Coil on Module CL

A thin module for more flexible, robust and forgery resistant ePassports

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Contents

Abstract

As globalization becomes more prevalent, so too are the number of passport holders and annual border crossings. In combination with a rising number of geopolitical conflicts, which result in an increase of migration, the annual number of border crossings will most likely continue to grow in the future. Under the current circumstances the motivation of travel document forgery increases as political conflicts grow. At the same time, while the current pandemic has curtailed cross border travel to a certain extent, there are signs that once we are post-pandemic, travel will slowly and steadily return to acceptable numbers and so too will the requirement for high security travel documents in volume.

Passport forgery is a real consequence of increasing globalization

The top target for fraudsters is the datapage, which contains the holder's personal data. Due to their security-critical character, official identification documents for travel must be developed according to the highest security standards in order to enable a reliable protection against aging, manipulation and fraud. Appropriate security is expected over an entire lifetime of the travel document which is typically up to ten years.

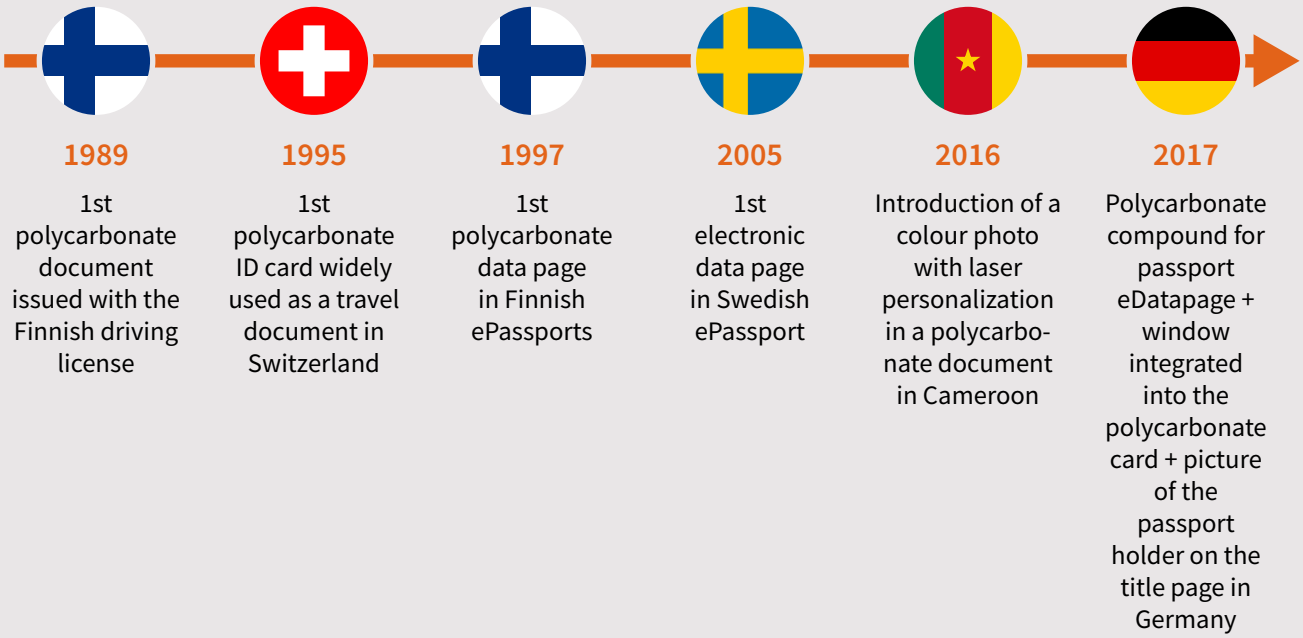
With such a scenario, it is increasingly important to improve protection against passport forgery. A developing trend in this field are polycarbonate datapages with an embedded security controller. **The combination of security IC and polycarbonate datapage has resulted in new possibilities to make passports even more forgery-resistant.**

The polycarbonate eDatapage

Over the last two decades, the exceptional performance of polycarbonate (PC) as a substrate for identification documents has made it the material of choice for datapages, outperforming laminated paper datapages in areas such as security and durability. Recent improvements in the sophistication of the polymer material itself, and in the laser systems that engrave it, have caused passport issuers to take notice. Over 40 countries have chosen it for their national identity or residence permit programs and close to 30 national passport programs are currently using it.

(Thales Group – More than two decades of innovation in polycarbonate:
https://www.thalesgroup.com/sites/default/files/gemalto/gov-infographic-poycarbonate.pdf)

More than two decades of innovation in polycarbonate:

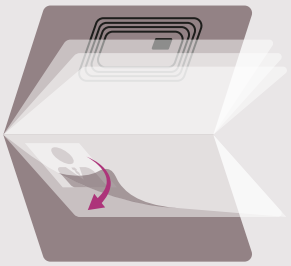


Since the first introduction into the passport world, a growing number of countries have adopted a polycarbonate datapage. Polycarbonate, due to its unique properties, has won the trust of governments as the material of choice for durability and tamper resistance.

The material attributes of polycarbonate with its multilayer structure, which is indivisibly fused after lamination is forming the so-called “polycarbonate Monoblock”. Enabling significantly more security features at multiple levels.
A so-called ‘polycarbonate Monoblock’ consists of ‘top to toe’ polycarbonate, which connects to one block during the lamination without any chance of delamination. With printing, security features and personalization on different layers inside the body and a tactical surface are possible. After the lamination process, the individual layers are closely combined, providing improved robustness and an increased tamper resistance.

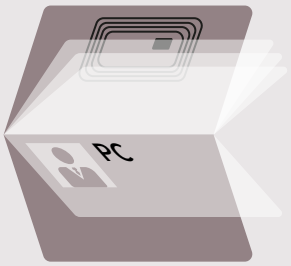
In comparison to conventional solutions, where the chip is located in the cover, polycarbonate datapages with embedded security controllers – the so-called eDatapages – increase protection against forgery significantly.

Common passport layouts with integrated circuit



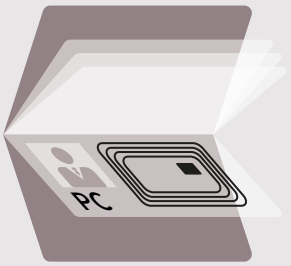
eCover + paper data page

› Electronics in the cover
› First generation of ePassport



eCover + Polycarbonate data page

› Electronics in the cover
› Improved security due to polycarbonate datapage



eDatapage

› Electronics in the PC data page
› Combination of polycarbonate and electronics in one page
› Latest development trend for highest security

During the production process, it is crucial to adhere to the element of a 100% ‘polycarbonate Monoblock’ even when introducing additional items such as security features or antennas: Having a wired antenna on polycarbonate continues to support the 100% Monoblock concept. It keeps the existing construction, as only the wire is inserted onto one of the existing polycarbonate layers and prevents a change of the lamination process, as no new material is brought into the card itself.

eDatapage guards against datapage manipulation

It is important that the datapage is designed and constructed to defend against a large variety of threats, as an attacker usually only needs to identify and exploit one weakness in order to access and manipulate the data contained therein. The security features of the datapage efficiently protect the document against manipulation. Usual attempts to mechanically destroy the chip itself are easily recognized as mechanical damages, e.g., scratches, will remain on the polycarbonate material as evidence of physical manipulation.

Therefore, the implementation of personal data on only one page makes the manipulation of the documents much harder.

The mechanical abrasion of the page – typically from the back – has been used by fraudsters for many years to reveal and alter personalization data. In this case, an effective defense depends upon the layers of security features and their design within the datapage, in conjunction with the antenna, which is necessary for every electronic passport, eDatapages result in an effective, easy, safe and convenient solution against counterfeiting. The antenna, for example, can be used as a prevention against such mechanical counterfeiting and manipulation techniques, which is known as 'Back Side Milling'.

Antenna as "Back Side Milling" protection

Figure 1: A special designed antenna is placed behind the photograph to reduce the possibility of manipulation through "Back Side Milling"

Polycarbonate can be susceptible to softening by certain organic chemicals, and a combination of mechanical and chemical methods can be utilized by criminals to access and alter data, more or less invisibly. However, even if it were possible to split the datapage, the result would be two separate pieces, each encapsulating and protecting the personalization within the fused PC blocks beneath a network of security features.

Advanced, multi-technology defenses include traditional print and personalization features as well as embossing, applied diffractive devices and transparent windows. Special antenna technologies with embossing or a Kinegram® or holographic feature also make it even more difficult to cover up such manipulations. Furthermore, the antenna can be used as an additional watermark which only appears when viewed by transmitted light similar to banknotes.

Current eDatapages can be thick – but not for much longer

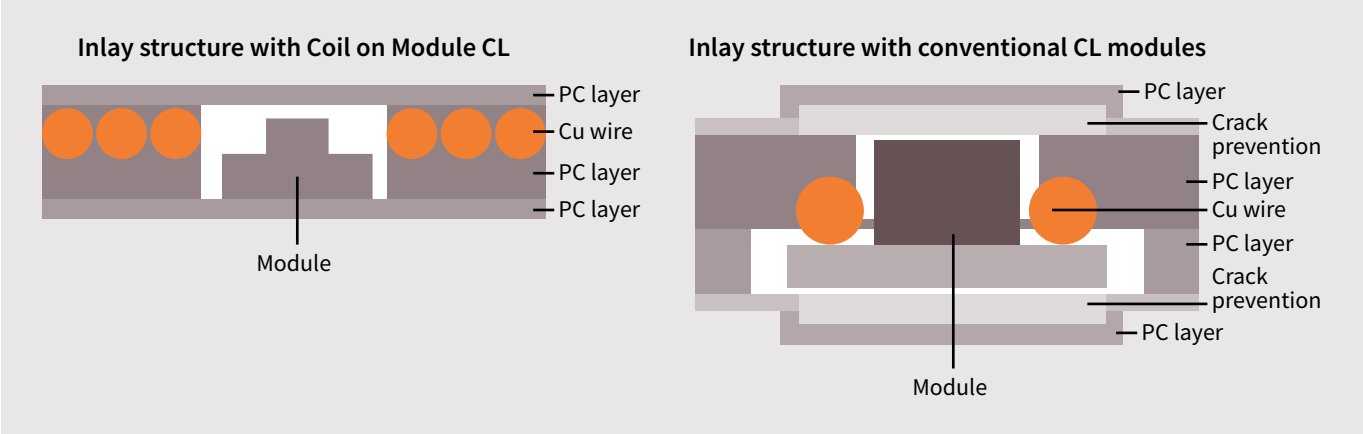
Looking at current module technologies. Because of its module design, standard contactless packages with over molded leadframe, which are currently applied for ePassports, require a multiple layer construction of compensation and crack prevention layers. This layer structure impairs the mechanical robustness of the passport as only relatively thick datapages are currently possible.

Furthermore, thickness for an inlay with standard module technology with over molded leadframe and copper wire is currently 330 µm, which results in datapages within an average thickness between 750 µm and 850 µm.

This leads to rigid and inflexible datapages, which do not meet the flexibility and haptics of traditional passports without polycarbonate datapages. Additionally, due to the high costs for polycarbonates, a thicker datapage is additionally more expensive than conventional solutions.

Infineon Technologies has developed a special package solution for highly robust, flexible and long-term reliable government ID and passport documents that will also allow for a thinner eDatapage – Coil on Module. Coil-on-Module also allows the option for the adding of additional security layers that can help guard against datapage manipulation.

While currently the standard thickness for an inlay with conventional module (such as MCS8) is typically 330µm, Infineon now has a package solution with inductive coupling technology for contactless inlays below 200µm, giving the end document manufacturer much greater flexibility. This may, indeed, bring a cost variable into the overall production cost equation as the reduction in polycarbonate material may offset the cost of additional security layers.



This is an attractive argument for passport manufacturers as they look to reduce the thickness of the datapage that carries the chip. The current goal is the reduction of the eDatapage using Coil-on-Module to 600µm and less.

Some manufacturers rely on the bare die flip chip solution, where the security controllers are placed directly without package on a printed or etched antenna. This technology is currently used in transport ticketing solutions. Direct flip chip enables thinner contactless inlays which results in a thinner eDatapage but also brings some downsides.

One example are aluminum antennas which are etched onto a PET (Polyethylenterephthalat) layer and then placed between the polycarbonate layers with special adhesives. The adhesive residue s that are required for gluing can lead to delamination. Both technologies also require huge antenna areas. These antenna areas can cause ghosting artifacts (the shape of the antenna is visible due to roughness and height differences) on the finished product.

Coil on Module contactless overcomes all these problems. The inlays have a thickness of below 200µm, giving the end document manufacturer much greater flexibility in terms of thickness and the potential of adding additional layers with all the benefits of standard copper wire solutions – although one should not underestimate the benefits associated with a thin, flexible eDatapage in terms of document usage and convenience.

Coil on Module contactless is an innovative package technology that is only 125µm thin, i.e., 50 % thinner than standard packages, and does not require conventional crack prevention. This enables innovative antenna techniques, thinner inlays with less visibility of the module, a polycarbonate monobloc, and delivers outstanding mechanical performance.

Coil-on-Module contactless

Coil on Module contactless is designed for highly robust, flexible and very thin polycarbonate eDatapages. The Coil on Module contactless technology is based on inductive coupling, which improves the possibilities due to the superior antenna connection technology.

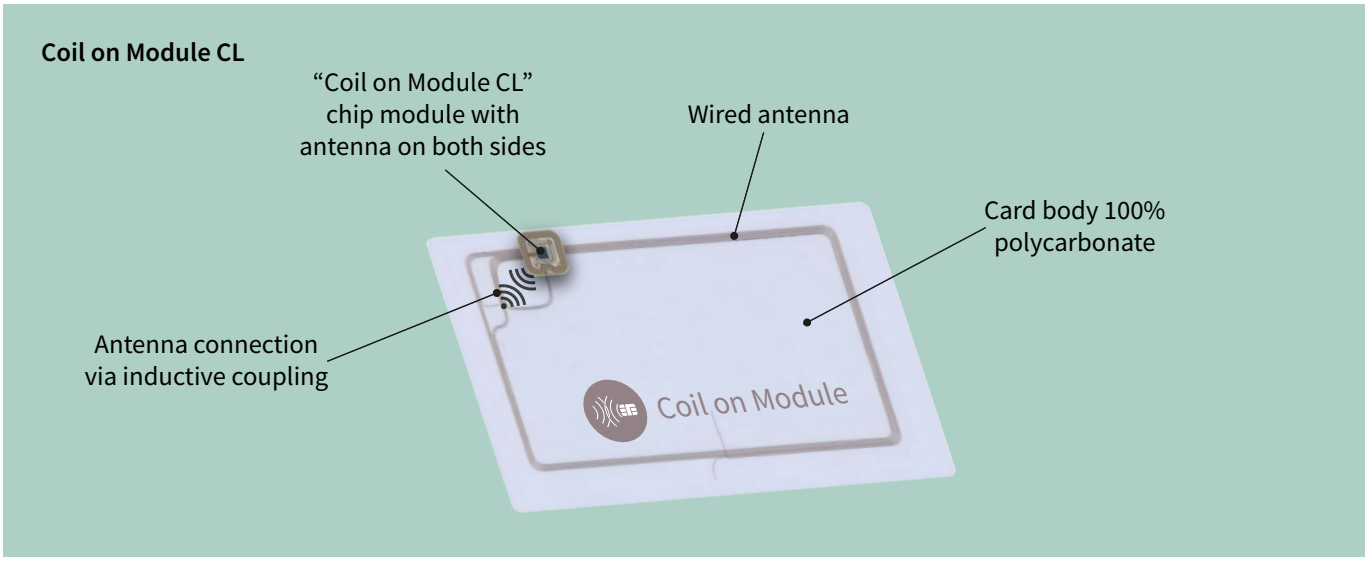


Figure 2: Inlay Laminated Contactless Module from Infineon

Unlike conventional package technologies, Coil on Module contactless uses electromagnetic waves for the connection between module and antenna. A small antenna on the chip module connects to a coupling area on a standard-sized antenna in the passport, using an electromagnetic field within the passport. Electromagnetic coupling substitutes mechanical coupling. This lack of mechanical galvanic connection with no soldered or welded connection massively minimizes the chance of breakage between module and antenna – a huge advantage for a passport with a ten-year lifecycle.

Due to the lack of direct connection, the Coil on Module contactless module can also be used as an additional optical security feature (highlighted in Figure 3) and may, in fact, reduce field returns as there is no physical connection between module and antenna.

Figure 3: Highlighting the Visible Coil on Module CL

Inductive coupling technology brings advanced ruggedness and flexibility

The benefits demonstrated by inductive coupling technology, will go a long way to delivering an advanced ruggedness of the datapage with enhanced tamper resistance, as well as a more flexible datapage. With these functionalities in place, the ten-year lifetime requirement of the passport becomes even more reliable.

The Coil-on-Module is a proven technology that enables contactless communication in combination with extremely robust packaging for hundreds of millions of payment and government applications in the market. Coil on Module contactless is the further development of this technology and is used in polycarbonate datapages as well as ID1 applications.

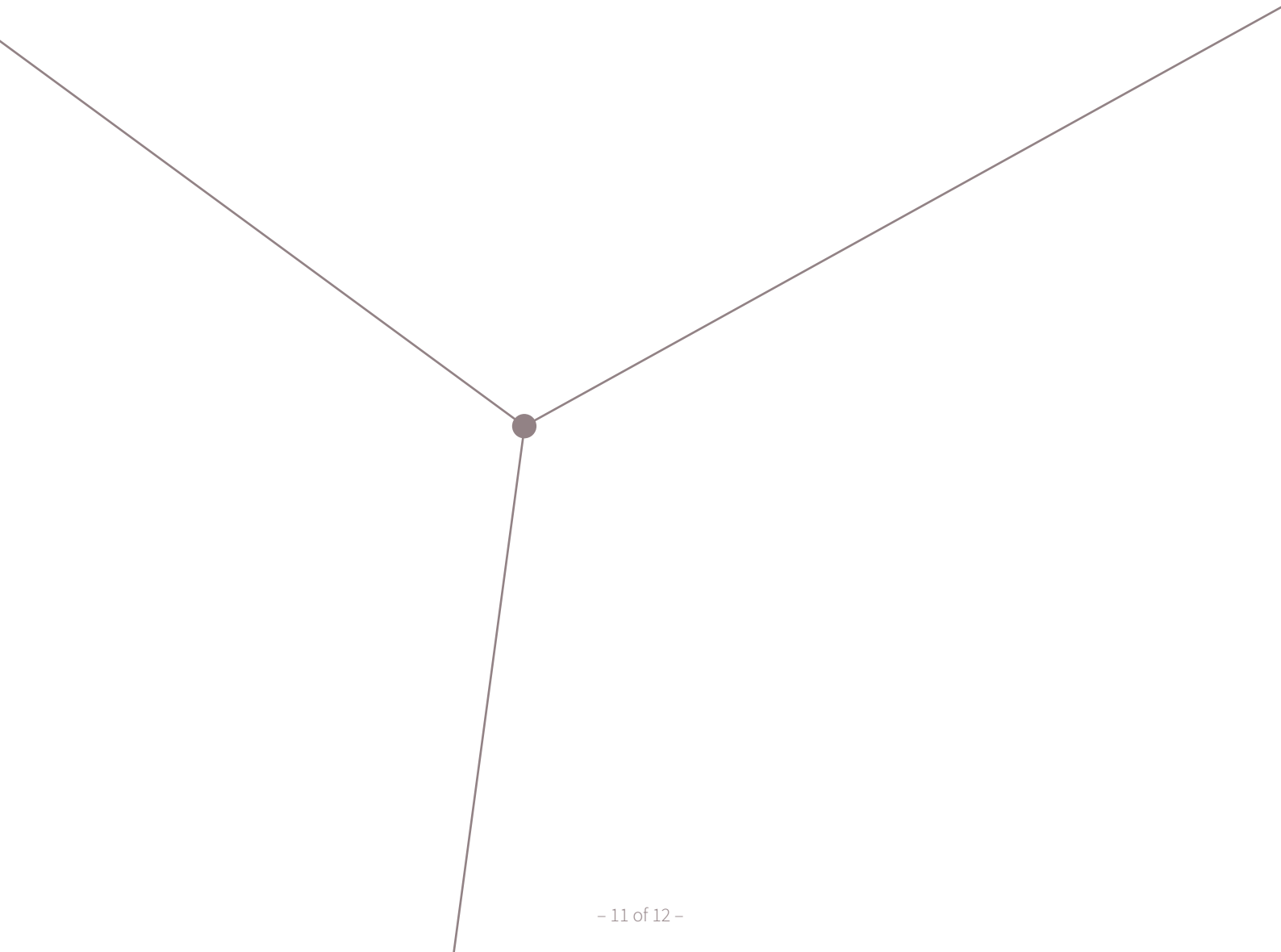
Conclusion

The move from traditional passport datapages to passports with eDatapages has meant the integration of one or more smartcard technologies into the production process.

With more applications being added to the functionality of a passport (electronic travel visas – or even time stamps – for example) there is a greater urgency for industry innovation in addressing the physical durability issues that are required to future-proof the credential of tomorrow. Requirements for tamper resistance, durability and flexibility in eDatapage design will increase as greater customization of the passport takes place alongside increased usage of the passport document.

The benefits demonstrated by inductive coupling technology, as well as Infineon's drive towards much leaner and thinner chip modules, will go a long way to delivering an advanced ruggedness of the eDatapage with enhanced tamper resistance, as well as a more flexible eDatapage.

Many ePassports today deliver a ten-year life time guarantee with a rugged and durable eDatapage. However, using Coil-on-Module contactless, the datapage become thinner and more flexibility and it is this very flexibility that allows a variety of enhancement to be made in terms of document security, be it the addition of security layers or using its very flexibility as a tamper-resistance asset in itself.



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