

Choosing RFID inlays

How customer requirements drive inlay design and selection.



As companies explore new ways to leverage RFID technology, work for converters is growing at a rapid pace. Some have tested the market by using a toll manufacturer for RFID insertions, while others have jumped in with their own equipment. No matter the scope of investment, inlay selection will be one of the most critical factors in a converter's RFID success.

Understanding customer requirements

The journey of an RFID tag or label through the supply chain is one of many variables inlay manufacturers must consider. For example, inlay production methods and substrate options may be of critical concern to an OEM dedicated to sustainable operations.

Other projects may involve inlay design considerations that range from readability through dense packaging to the distance between tags and readers. Asking the right questions of your customers requires that converters have a basic understanding of inlay design.

Proper inlay selection will help guide production line requirements after they have identified each customer's goals and desired performance metrics.

Design considerations

As communications protocols and frequency spectrums become more consistent globally, standardized integrated inlay units – made up of a chip and antenna built onto a flexible carrier – are emerging in more RFID applications. However, most applications still require some level of customized inlay design.



Variables most relevant to inlay design include: Product features – The material characteristics of the product, from its composition (metal, plastic, etc.) to its size and shape will affect the material requirements, size and shape of its RFID tag. RFID inlays can also be encapsulated to add durability and temperature resistance for the application.

- ▶ **Radio frequency.** Visualizing the lifecycle journey of the product as it moves through the supply chain will help determine the radio frequency requirements of the inlay. Considerations include the product's distance from readers, the packaging used and any signal interference related to the surrounding environment.
- ▶ **Tag features.** The material characteristics of the tag, its graphics and other printing requirements are major factors in inlay design. Equally important are the tag's positioning during the product's journey through the supply chain, both within the sales environment and after its delivery to the end user. Anticipating and accommodating for these variables will ensure successful inlay performance.
- ▶ **Chip memory.** Chip manufacturers offer a broad range of options, but a 96-bit capacity chip is sufficient to provide unique identifying information for most RFID applications. However, the Electronic Product Codes used in complex industrial environments such as automotive may require capacities as high as 640 bits.
- ▶ **Strap versus direct attachment.** Although direct attachment is the most common method of attaching inlays to their substrates, a strap design allows for much more design flexibility. That is particularly beneficial to converters, requiring a rapid progression from initial design to prototyping and pilot runs.
- ▶ **Wet versus dry.** Adhesive-backed inlays are most common and can be used when no ancillary operations are required. These 'wet' inlays typically come in rolls and can be quickly peeled off and adhered to the product. A wet inlay is delivered to the converter attached to a pressure-sensitive liner; a dry inlay is attached to the label without the use of adhesive.
- ▶ **Sustainability.** Customers dedicated to environmental sustainability may prefer paper or fabric carriers over plastic substrates, or may require a cradle-to-grave environmental impact analysis before determining the best inlays for their products.
- ▶ **Regulatory compliance.** Designs must comply with the various regulatory environments in which the converter's customers operate. A full-service inlay manufacturer should be able to provide design options that are REACH and/ or ROHS compliant, and that meet industry requirements.

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Developing a custom solution

The variables involved in RFID inlay design are numerous and can be perceived as complex. But armed with the knowledge to explore each customer's design criteria, a full-service inlay manufacturer can help converters translate customer requirements into an appropriate custom solution.

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