

## Inside *iCoupler*® Technology: Package and Lead Frame Design

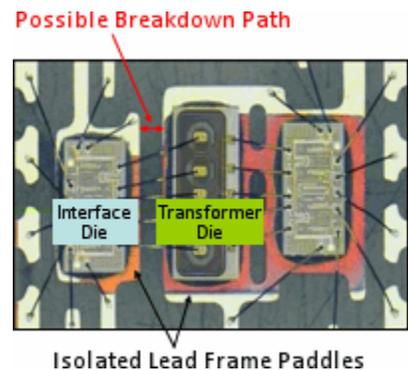
By Baoxing Chen, Design Engineer

In a previous Inside *iCoupler* Technology issue, we described how *iCoupler* products' isolation characteristics are dependent on the polyimide insulation material between the top and bottom transformer coils. In this issue, we explain how package design and materials are also crucial elements for ensuring the isolation characteristics of our products. With *iCoupler* products, we take great care designing the package and lead frames and also selecting the molding compound in order to achieve isolation ratings up to 5 kV rms reinforced insulation.

With regards to the external package dimensions, certain minimum spacings are required in order to satisfy applicable safety standards. Creepage and clearance distances are defined as the shortest distance between conductors on either side of the isolation barrier either along the package surface (creepage) or in a line-of-sight through the air (clearance). The packages used for *iCoupler* products have been approved by CSA, VDE, TUV, and UL for distances of clearance/creepage distances of at least 4mm or 8mm. These spacings are adequate to meet safety requirements of the most common applications involving isolation.

Within the package, to guarantee isolation ratings of up to 5 kV rms, we make sure that there is adequate separation through the package molding compound between conductors on either side of the isolation barrier.

The figure to the right shows an example of one possible breakdown path. This path is between two paddles on which different die are attached - *iCoupler* products use multiple die in the package to encode and decode signals transferred across the transformer isolation barrier. Each paddle can be at a separate voltage potential differing by thousands of volts. The breakdown characteristics of this path are dependent on the distance through the molding compound between the two paddles.



This distance must be long enough to achieve the specified 1 minute isolation rating associated with a given *iCoupler* product (2.5 kV rms or 5 kV rms for most *iCoupler* products). In production the isolation barrier on each *iCoupler* product is tested at either 3 kV rms or 6 kV rms. We selected a package molding compound with a breakdown strength of at least 20 V peak/ $\mu\text{m}$ . This translates to a paddle separation requirement of at least 210  $\mu\text{m}$  separation for 2.5 kV rms products and 420  $\mu\text{m}$  for 5 kV rms products. *iCoupler* packages are designed to meet these separation distances.

A common question with *iCoupler* products relates to a distance-through-insulation requirement that is often perceived to apply. In actuality, current versions of the most commonly applicable safety standards do not have distance-through-insulation requirements for semiconductor-type devices with casings completely filled with an insulating compound. Some safety standards require additional testing involving temperature cycling and elevate voltages to ensure the integrity of internal insulating materials. See, for example, IEC 60950-1 (2nd edition) or IEC 61010-1 (2nd edition).

In summary, while *iCoupler* isolators use industry-standard packaging, the package, lead frame, and molding compound have been optimized to ensure that *iCoupler* products meet up to 5 kV rms isolation ratings and comply with various safety standards. For more information on *iCoupler* safety approvals, please visit [www.analog.com/icouplersafety](http://www.analog.com/icouplersafety).

Visit our website, [www.analog.com/icoupler](http://www.analog.com/icoupler) to learn more about our latest, award winning *iCoupler* technology, download data sheets and order free samples, or email us directly at [iCoupler\\_Isolation@analog.com](mailto:iCoupler_Isolation@analog.com).