

## Analog Devices' Digital Isolation Update *iCoupler*® News

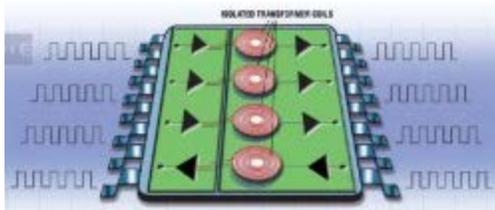
Welcome to the second edition of Analog Devices' Digital Isolation Update. Whether you are already using *iCoupler* technology or still designing with optocouplers, this Digital Isolation Update will keep you posted as we continue to introduce a wide array of new isolation products, including gate drivers, transceivers, and multi-channel digital isolators with *isoPower*™ isolated, integrated DC/DC converters.

Each Digital Isolation Update includes a look at [New Products](#), [General News](#), a special application note we call "[NAppkin Notes](#)" and will also present insights and interesting facts in [Inside \*iCoupler\* Technology](#).

We are always looking for feedback, so please feel free to e-mail us at:  
[iCoupler\\_Isolation@analog.com](mailto:iCoupler_Isolation@analog.com).

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### New *iCoupler* Products



#### ***ADuM3440 / ADuM3441 / ADuM3442***

The newly released ADuM344x are the fastest digital isolators in the *iCoupler* product portfolio, with a guaranteed data rate of at least 150 Mbps. These quad channel digital isolators add a new level of performance along with the already

established benefits of the *iCoupler* technology, including small size, low power consumption and excellent reliability. Available in three different I/O configurations, the ADuM344x products are ideal for applications requiring fast data transfer with low propagation delay, including instrumentation and high-speed data SPI-based converters. For more information, please visit [www.analog.com/ADuM344x](http://www.analog.com/ADuM344x).

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### General News



#### ***Updated *iCoupler* Reference Information***

We have recently updated two documents that frequent questions about our *iCoupler* technology and products. The FAQ covers a wide range of questions about the background of *iCoupler* technology, safety approvals and range of offered products, among other topics. The updated FAQ is available at [www.analog.com/iCoupler](http://www.analog.com/iCoupler). Earlier this year, we also

updated our "Common Questions About *iCoupler* Technology" for customers with very specific concerns about reliability, ESD performance and magnetic field immunity. The updated file is available at [www.analog.com/iCoupler](http://www.analog.com/iCoupler). If you have any questions or concerns that are not addressed by these reports, please contact us at [iCoupler\\_Isolation@analog.com](mailto:iCoupler_Isolation@analog.com).

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*NAppkin Notes* – written expressly for the Digital Isolation Update – are ideas, hints, and tips for building with *iCoupler* technology.



**NAppkin Note:**  
**Isolating RS232 with *i*Coupler Technology**  
 By Mark Cantrell, Applications Engineer

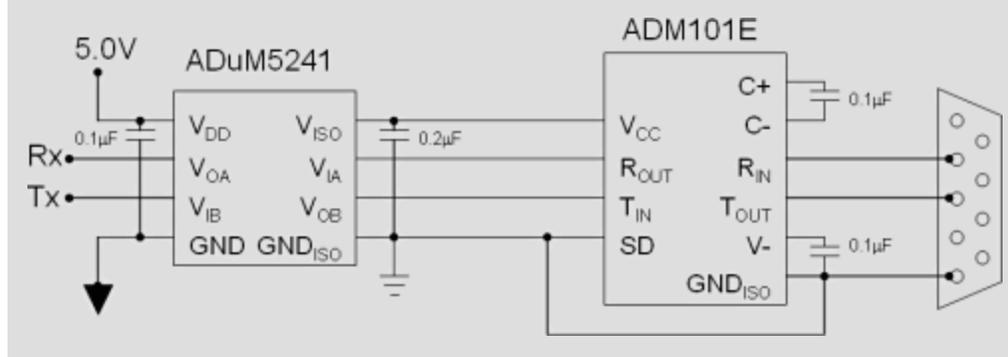
RS232 continues to be the interface of choice when instrumentation, industrial equipment and medical devices need to have standardized, low-speed data and control interface. In applications that require isolation for safety or ground loop reasons, RS232 is, fortunately, straightforward to isolate because of its low-speed and unidirectional signals.

While isolating RS232 data signals may be straightforward, there does remain the challenge of isolating the power source that supplies the transceiver. The figure below offers an extremely compact and simple design using the new ADuM5241 *i*Coupler featuring *iso*Power™. Complete data and power isolation needs are met for a single Tx/Rx pair using a single ADuM5241.

The transceiver chosen for this application is the ADM101E. This part operates on a 5V power supply and includes a charge pump to produce a -5V rail in the transceiver. Since the charge pump does not step up the voltage, the +/- 5V swing in the outputs source less current into both static and dynamic loads. This allows the design to produce high data rates even into relatively heavy resistive and capacitive loads. This port can drive a 50 foot cable at about 300 kbps within the 10mA output power budget of the ADuM5241.

Although the ADuM5241 is not a high efficiency converter, there are options that allow the ADuM5241 to support low power applications. The input current at 5V is nearly 120mA (600mW) under full load, which can be more power than a designer would like to expend for an I/O port. Fortunately, the ADuM5241 has a shut down feature that can reduce power consumption to only 13mW if the RS232 port is not being used. Shut down is achieved when  $V_{DD}$  is reduced below 4V, shutting down the DC/DC converter section of the ADuM5241 so that the data channels draw only 13mW. No power is produced at the secondary when operating in this mode.

The entire RS232 isolated solution shown below requires only 44mm<sup>2</sup> of component area and costs only \$3.57 in quantities of 1,000 units. For more information on the ADuM524x family of *i*Coupler products with *iso*Power, please visit [www.analog.com/ADuM524x](http://www.analog.com/ADuM524x) or send an email to [iCoupler\\_Isolation@analog.com](mailto:iCoupler_Isolation@analog.com).

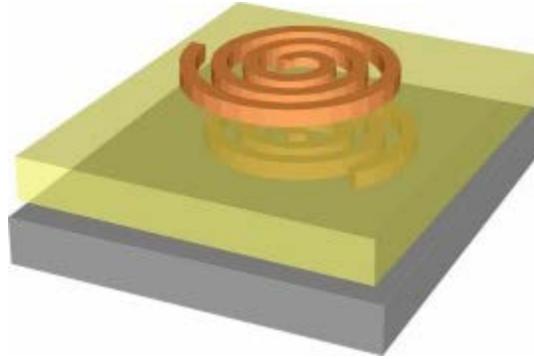


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## Inside *i*Coupler Technology

by Baoxing Chen, Design Engineer

The key to *i*Coupler products' high



voltage isolation performance is the 20 $\mu$ m polyimide layer sandwiched between the top and bottom coils of the *iCoupler* chip-scale micro-transformers.

Polyimide was chosen as the insulating material for many reasons including excellent breakdown strength, thermal and mechanical stability, chemical resistance, ESD performance and relative permittivity.

Commercial polyimide films are available in photo-resist form that are deposited on wafers with well controlled thicknesses and then easily patterned with standard photolithography processes. The polyimide is then cured to achieve high structural quality. The resulting polyimide layers used in *iCoupler* devices are 20 $\mu$ m thick with a dielectric breakdown strength over 400V/ $\mu$ m; this enables *iCoupler* products to survive over 8kV instantaneous ac voltage. Because deposited polyimide films are free of voids and do not suffer from corona discharge, *iCoupler* devices also exhibit good aging behavior and work well under continuous ac voltages and dc voltages.

Besides good high voltage performance, polyimide has excellent ESD performance, capable of handling EOS and ESD events exceeding 15kV. During energy limited ESD events, the polyimide polymer absorbs some of the charge to form stable radicals that interrupt the avalanche process and bleeds away some of the charge. Other dielectric materials such as oxide typically do not have this ESD tolerant characteristic and may go into avalanche once the ESD level exceeds the dielectric strength, even if the ESD energy is low.

The *iCoupler* polyimide also has high thermal stability; with a weight loss temperature over 500°C and a glass transition temperature of about 260°C. The polyimide also has high mechanical stability with a tensile strength over 120MPa and a high elastic elongation over 30%. In spite of its high elongation, polyimide does not deform easily, because the Young's Modulus is about 3.3Gpa.

The polyimide has excellent chemical resistance which is one reason it has been widely used for insulation coatings for high voltage cables. High chemical resistance also helps to facilitate IC processing on top of polyimide layers, such as the Au plating used to create *iCoupler* transformer coils.

Lastly, the thick polyimide layers, with a dielectric constant of 3.3, work well with the small diameter Au transformer coils to minimize capacitance across the isolation barrier. Most *iCoupler* products exhibit less than 2.5 pF capacitance between input and output.

Because of these characteristics, polyimide is increasingly used in microelectronics applications, and it is an excellent choice as insulating material for the *iCoupler* high voltage digital isolators.

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).



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