

Analog Devices' Digital Isolation Update *iCoupler*[®] News

Welcome to the first edition of Analog Devices' Digital Isolation Update. Whether you are already using *iCoupler* technology or still designing with optocouplers, this new 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 will include 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](#).

New *iCoupler* Products



ADuM5240 / ADuM5241 / ADuM5242

The ADuM524x are the first *iCoupler* products with *isoPower* – data and power integrated into a single package. These dual channel products isolate data signals up to 1 Mbps, and they can also generate 50 mW (10 mA at 5V) of isolated power from a 5V supply. Available in three different I/O configurations, the ADuM524x products are ideal for remote sensors, transceivers, converters etc. that require small amounts of isolated power. For more information, please visit www.analog.com/ADuM524x.

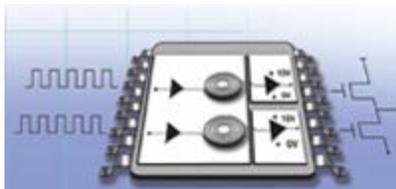
ADuM2250 / ADuM2251

The ADuM2250 and ADuM2251 are 5 kV rms isolation versions of the award winning ADuM1250 and ADuM1251 I²C bidirectional isolators. These new products are available in a 16-lead wide body SOIC with more than 8 mm creepage, and they are tested to meet 5 kV standards. The ADuM225x products have received CSA approval for reinforced insulation per IEC 60601-1 for medical applications. For more information, please visit www.analog.com/ADuM225x.



ADuM1234

The ADuM1234 is similar to the ADuM1233 isolated half-bridge gate driver, but this new product features CMOS logic levels instead of the TTL levels employed by the ADuM1233. The ADuM1234 has two isolated 15V outputs that are isolated not only from the inputs but are also isolated from each other. The ADuM1234 is well suited for power supply and motor control applications. For more information, please visit www.analog.com/ADuM1234.



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General News



Reinforced Insulation Approved by VDE

iCoupler products have now been approved for reinforced insulation by VDE. Until recently, no VDE standard covered reinforced insulation for magnetic couplers such as the *iCoupler* family of digital isolators; however, VDE released DIN V VDE V 0884-10 (VDE V 0884-10) in December 2006, and *iCoupler* products successfully completed testing to this standard. For details about specific working voltages and

isolation ratings for each iCoupler product, and to view the safety certificates, please visit

www.analog.com/iCouplerSafety.

Updated Data Sheets

As of August 1, 2007 other iCoupler data sheets have been updated to reflect the changes in VDE approvals. While no changes were made to specifications, cosmetic changes were made and some minor errors were corrected. Please be sure to download the latest versions by going to www.analog.com/iCoupler.

New Application Note: Isolating I²C Interfaces

Application note [AN-913](#) is now available online. This note explains how to use the ADuM125x and ADuM225x bidirectional iCoupler products to isolate I²C buses.

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NAppkin Note



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

NAppkin Note: Using isoPower to Build a Solid State Relay

by Mark Cantrell, Applications Engineer

Off-the-shelf Solid State Relays (SSR) are reliable and compact, but it's hard to find one that can conduct more than a few hundred milliamps of current. If you need an isolated SSR to switch line voltages, for example, you may just have to build one yourself out of power FETs. You could use optocouplers to provide galvanic isolation between the control and the FET gates, but where would you get enough power on the isolated side for the optocoupler to actually drive the FET gates?

The figure below shows how you might use the ADuM5240 to build an SSR. The ADuM5240 has two data channels to drive two FET gates, and each channel can source up to 20 mA into a capacitive load. The ADuM5240 also features *isoPower*, an integrated, isolated DC/DC converter that provides the secondary with plenty of power to switch discrete power FET gates at high repetition rates and good gate slew rates.

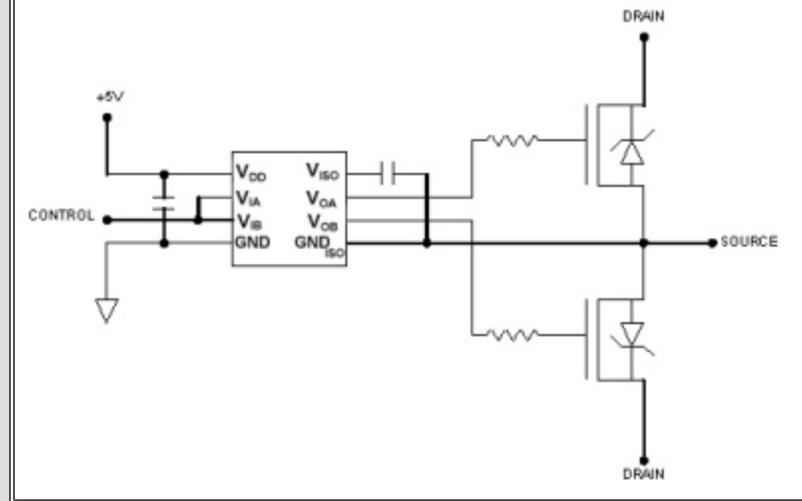
Combining the power and signal drive capabilities of the ADuM5240 allows large voltages and currents to be controlled. The primary requirement on the FET is that its gate threshold be below the 5V provided by the ADuM5240. Any other combinations of current and voltage are limited only by the chosen FETs.

The example circuit below was built using IRF540N N channel hexfets with 250 ohm gate resistors. The back-to-back configuration of the FET provides linearity in impedance across 0V when the device is on and symmetrical voltage blocking when the device is off. If a normally closed relay is desired, a p-channel FET can be used. This circuit is capable of switching 30A at up to 100V and the turn on time is about 20uS. This is very fast compared to optocoupler-based SSRs and mechanical relays.

This *isoPower*-based relay can modulate power in the kHz range, which is fast enough to dim incandescent light bulbs or provide speed control for a DC motor. With appropriate FET choices, one can readily construct a line power switch. This versatile switch can be constructed at lower cost than SSR modules or opto-MOS components.

For more information on the ADuM524x family of iCoupler products with *isoPower*, please visit www.analog.com/ADuM524x or send e-mail to iCoupler_Isolation@analog.com.





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Inside *iCoupler* Technology

by Baoxing Chen, Design Engineer



At the heart of the *iCoupler* technology are planar transformers that transmit and receive signals across an isolation barrier.

These transformers are fully integrated with standard semiconductor manufacturing processes, and they consist of two coils separated by a layer of polyimide that acts as the isolation barrier. Each coil is about 500 μ m in diameter with 15 turns. The top coil is 4 μ m thick and made from gold; the bottom coil is 1 to 2 μ m thick and made from aluminum.

These planar, chip-scale transformers have some unique characteristics that do require some consideration when developing a digital isolator; however, these characteristics can also be taken advantage of to produce novel digital isolators.

First, *iCoupler* transformers are air core transformers – there is no magnetic core. To achieve tight mutual coupling we stack the two 15-turn 500 μ m diameter coils directly on top of each other with a separation of only 20 μ m. This results in a coupling coefficient greater than 0.8.

Second, *iCoupler* transformers have very high bandwidth. The top and bottom coils have self-resonant frequencies of 1 GHz and 400 MHz, respectively, and the capacitance between the coils is less than 0.3 pF. The combination of high bandwidth and low capacitance means that the *iCoupler* technology is capable of supporting very high speed digital isolators.

Third, *iCoupler* transformer coils have low inductance, about 110 nH each, and high resistance, 25 Ohms for the gold top coil and 50 Ohms for the bottom aluminum coil. This L/R ratio makes it difficult to directly pass low-frequency signals – the transformers can easily become current saturated if the input pulse width is wider than the L/R ratio, or a few nanoseconds.

To get around the low-frequency limitations of these coils, we use a novel encoder circuit to send only very short pulses, 1 to 2 ns wide, through the transformers regardless of the frequency of the input signal. The decoder circuit reconstructs the output signal based on these 1 to 2 ns wide pulses. This encode/decode approach allows *iCoupler* products to transmit DC levels as well as very high frequencies.

Finally, by using gold for the bottom coils as well as the top coils, and by increasing the coil thicknesses to reduce resistance, we can optimize the transformers to transfer power across the isolation barrier. This can be done without compromising the signal isolation, resulting products such as the ADuM524x with *isoPower* that integrate isolated data and power into one package.

With these unique characteristics of *iCoupler*'s planar transformers and some novel circuit design, *iCoupler* products can integrate many different features and functions into one package without compromising performance.

Visit our website, 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.



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