

High Speed Optocouplers in Industrial Communication Networks

Introduction

The ACSL-7210 is a dual-channel bi-directional 25 Mbd high speed digital optocoupler optimized for full duplex industrial communication applications for example PROFIBUS fieldbus and Serial Peripheral Interface (SPI). The ACSL-7210 utilizes Avago's proprietary IC and patented packaging technologies to achieve 3,750 VRMS signal isolation in a low profile SO-8 package while supporting high speed full-duplex data communications with data rates of maximum 40ns propagation delay.

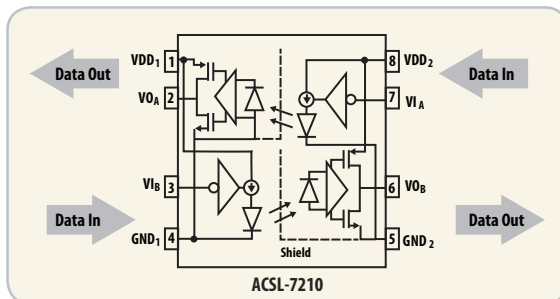
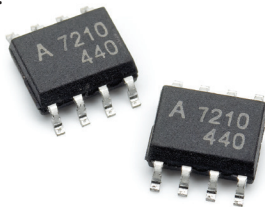


Figure 1: ACSL-7210 block diagram.

Patented Packaging and Stacked LED Technologies

Avago's patented packaging process of stacking LED die directly on a silicon IC substrate enables higher integration in monolithic IC packaging and low profile. Figure 2 shows a cross-sectional view of one of the two channels in ACSL-7210. Input logic signal controls the CMOS LED driver buffer IC, which supplies current to the LED. The

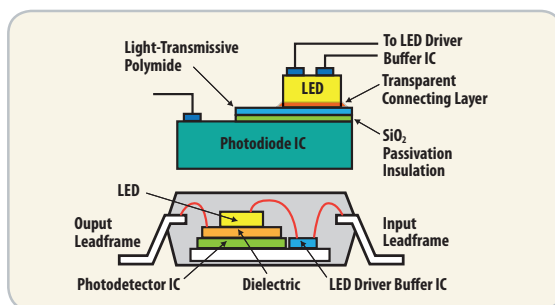


Figure 2: Cross-sectional view of one channel in ACSL-7210.

photodetector IC comes with two transparent layers: SiO2 passivation or insulation, and light-transmissive polyimide on top. The LED attaches to the photodetector IC with a transparent connecting layer. Standard die attach process is used to make all the placements.

Unlike conventional standard LED that emits lights on the same side as the metal contacts, Avago develops the back emission LED that emits light from the reverse side of the LED. This allows LED to stack on top of the detector IC.

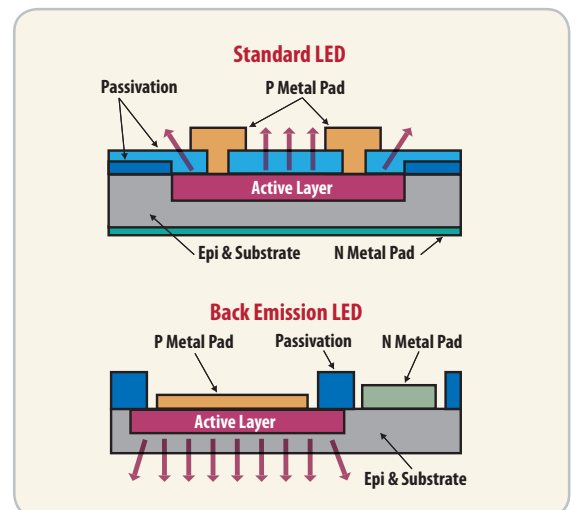


Figure 3: Standard LED vs Back Emission LED.

This patented packaging technology provides the advantage of high integration, with ACSL-7210 being a dual-channel bi-directional optocoupler utilize for PROFIBUS isolated data communication applications. Another advantage is low profile package (See Figure 4). ACSL-7210 can be mounted on the back-side of the PCB board to maximize the use of board space.

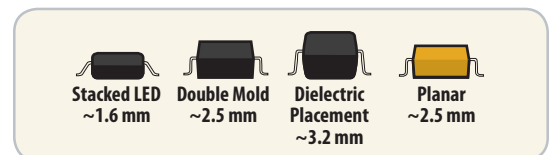


Figure 4: Profile packages comparison.

Industrial Communication Networks

Fieldbus (or field bus) refers to a family of industrial computer network protocols used for real-time distributed control of instruments. As shown in Figure 5, an automated industrial system such as a manufacturing

assembly line usually needs an organized hierarchy of controller systems to function. From the top hierarchy is a Human Machine Interface (HMI) where an operator can operate the industrial system. This is typically linked to a middle layer of programmable logic controllers (PLCs) by a non-time-critical communications system such as Ethernet. At the bottom of the control hierarchy is the fieldbus that links the PLCs to the “assembly line” components, such as sensors, actuators, electric motors, switches, and valves. In such industrial environment, high voltages, magnetic fields and noise are commonly present. High reliability is also critical to avoid production downtime and ensure data transmission accuracy. Using optocouplers such as ACSL-7210 address to these isolation needs.

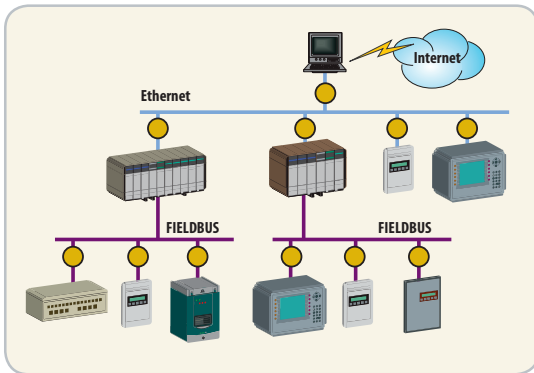


Figure 5: Hierarchy of controllers and instruments in automated industrial system.

Figure 6 shows the typical application diagram for 25MBd bi-directional ACSL-7210 and 10MBd ultra low power ACPL-M61L providing isolation in PROFIBUS (RS485) communication. ACSL-7210 isolates the transmitting and receiving data channels while ACPL-M61L isolates the transmit enable signal.

Summary

With its patented packaging and stacked LED technologies, dual-channel bi-directional 25MBd ACSL-7210 optocoupler meets the high switching speed and small package size requirements from industrial communication networks, for example PROFIBUS applications in noisy industrial environments.

Reference

1. ACSL-7210 product page
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2. ACSL-7210 product brief
www.avagotech.com/docs/AV02-4094EN
3. White Paper “Fieldbus Applications with Optocouplers”
www.avagotech.com/docs/AV02-3090EN

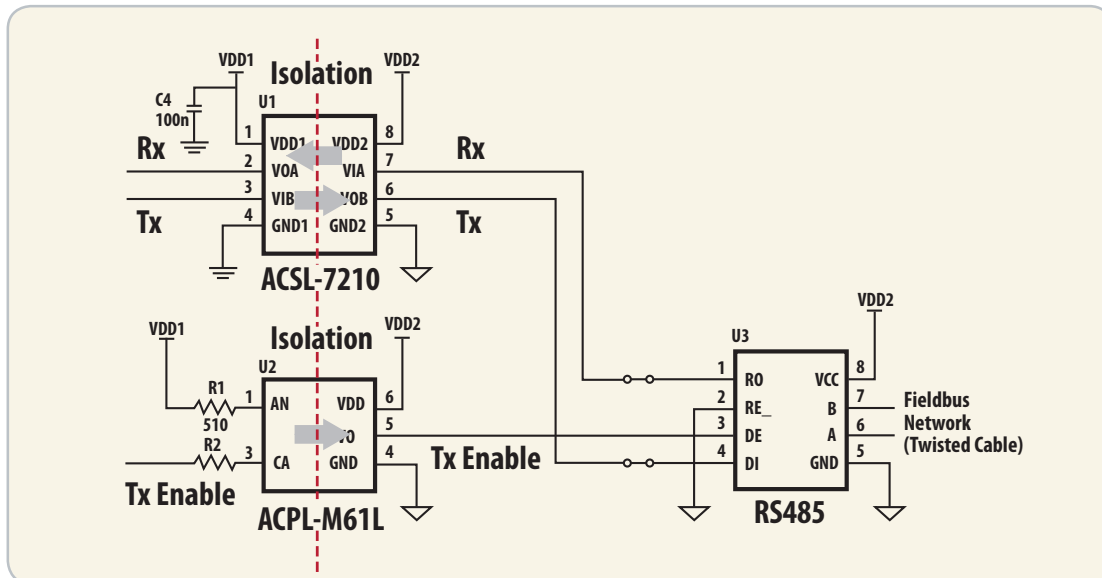


Figure 6: Isolated PROFIBUS (RS485) communication using ACSL-7210 and ACPL-M61L.

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