Solid State

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THE LIGHT CONNECTION

WHETHER you're a dedicated experimenter or a casual hobbyist, chances are you're always looking for something new to try—a new circuit to breadboard, perhaps, a new device to work with, or a new project to assemble. Certainly, anything new is exciting, different and challenging; but in the search for "newness" one shouldn't neglect older devices. If you haven't looked at optoelectronic couplers recently, for example, you may be in for a big surprise. Using infrared or visible light as a coupling medium, the early devices were relatively simple, comprising a LED light source and a low-voltage phototransistor or photodiode in a single package. Today, however, you can obtain off-the-shelf devices offering high-voltage transistors, high-gain Darlington pairs, and even thyristor outputs as well as conventional diodes and transistors. The expanding array of optoelectronic couplers can be used in a whole galaxy of interesting projects, with the number of potential applications limited only by the imagination, skill and knowledge of the circuit designer.

Let's look at a few of the many different circuits in which optoelectronic couplers can be used. Abstracted from device data sheets published by Motorola Semiconductor Products, Inc. (Box 20912, Phoenix, AZ 85036), these designs feature standard commercial components available through franchised local as well as mail order distributors. Intended primarily for interface applications—that is, to provide isolation between a signal or control source and another stage or load—the circuits are suitable for use in a variety of worthwhile and exciting projects, including computers, data processors, communication systems, alarms, remote controls, data transmission links, electronic musical instruments, test equipment, and electronic games. Depending on the specific application, the individual circuits may be incorporated into complete equipment designs or used primarily as interface elements between subsystems. Generally, the circuits can be duplicated using conventional assembly and wiring techniques, for neither layout nor lead dress should be overly critical as long as good construction practice is observed.

Featuring the Motorola 4N25 series (4N25, 4N25A, 4N26, 4N27, and 4N28), the circuits shown in Fig. 1 represent typical applications for a low-voltage LED/phototransistor coupled pair. Supplied in 6-lead miniDIP's, each device comprises a gallium-arsenide infrared LED optically coupled to an npn silicon photo transistor. In each, the LED has a maximum V_R rating of 3.0 volts and a maximum continuous forward current rating of 80 mA, although it can tolerate narrow pulse peak currents of up to 3.0 A, while the phototransistor has a maximum V_{CEO} rating of 30 volts and a maximum power dissipation of 150 mW (at 25°C). All devices in the series have a typical frequency response of 300 kHz and offer a minimum isolation voltage of 7500 V.

Suitable for applications in equipment and system designs using a combination of TTL and PMOS IC's, the TTL to PMOS logic translator circuit given in Fig. 1A uses a 4N25 series device in conjunction with an MPS6516 pnp common-base buffer amplifier. A typical subsystem interface application is shown in Fig. 1B; here, a pair of optoelectronic couplers serve as interconnection line drivers between a computer and one of its peripheral instruments (such as a data logger), providing both line and dc isolation. Quite versatile, the basic optoelectronic coupler also can be used to drive a power amplifier or to gate an SCR, controlling the power delivered to an inductive load such as a motor or solenoid.

Fig. 1. Optoelectronic applications: (A) Logic level translator; and (B) Computer/peripheral interface.