# SSR 2.0

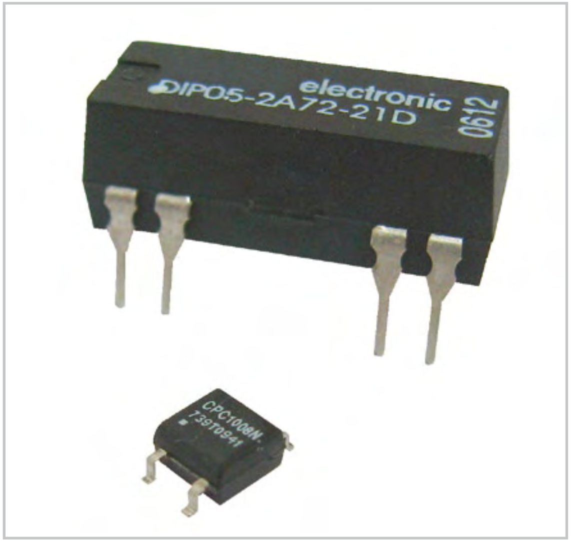
## OptoMOS semiconductor relays

Fredi Krüger **(Germany)**

OptoMOS or PhotoMOS relays are something of a special category. Looking at a block diagram the device falls somewhere between an optocoupler and a conventional SSR (Solid State Relay).

To compare technologies the input signal to a standard analogue optocoupler modulates the light of an LED. The light induces a current in an isolated phototransistor or Darlington. The output current from this type of device is relatively small (a few milliamps) and is approximately proportional to the input signal.

Solid state relays by comparison have a similar input LED but this time the light is used to trigger a built-in triac or thyristor. They are used to switch AC loads and some variants include circuitry to ensure switching occurs as the AC passes through zero. This reduces switching EMI but also makes them unsuitable for phase control applications.

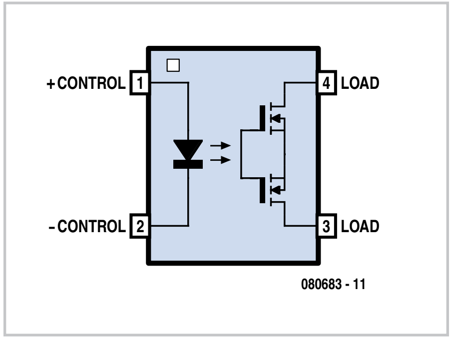



Conventional mechanical relays have been around for years. They switch both AC and DC supplies and can be designed to handle high current and voltage. Standard semiconductor relays can switch high current and high voltage loads but are not suitable for DC supplies and cannot be switched at high frequency.

Taking a closer look at the block diagram of a typical modern optoMOS relay shows an LED at the input as in the a normal optocoupler, but this time the light is used to switch two complementary photo MOSFETs which form a bidirectional switch. This bidirectional configuration is capable of switching both AC and DC supplies at speeds of around 1 ms. Most of the major IC manufacturers produce their own versions and amongst those stocked by one supplier include NEC (PS7141-2B), International Rectifier (PVN012APbF), Clare (LBB110) and Vishay Semiconductors (LH1502BB). The characteristics of these devices range from a maximum load current from 50 mA to 10 A with a voltage range from 20 V up to 2 kV. The switch resistance can be as low as a few mΩ to 100 Ω and the input control current ranges from around 2 mA to 10 mA depending on the type of relay. Some other manufacturers are Toshiba, Fairchild, Aromat (NAiS), Panasonic, Sharp, Cosmo and Avago. Some of the advantages of OptoMOS relays are:

- Small package outline — also in SMD!
- Long service life
- No contact wear
- No contact bounce
- No generation of EMI
- High switching speed
- Insensitivity to vibration
- Insensitivity to magnetic fields
- No magnetic field emission
- Low control power requirements

There are several different package outlines including one with eight relays in the same




package. When choosing a relay for a particular application the description will include the specification 'X form Y'. X is a number indicating how many switches are in the package and Y indicates the type of contact: 'B' = normally closed while 'A' = normally open. Some of these relays have both normally open and normally closed in the same package, useful for making a changeover switch.
In the Elektor labs we took a look at the TLP4227G-2 from Toshiba. This 8-pin version is described as '2 form B', i.e. two normally closed relays. The contacts are capable of switching 350 V at 150 mA. Without any current flowing in the LED the device is on and we measured an output resistance of 15 Ω. With an LED current of 0.5 mA the resistance starts increasing and at around 0.9 mA it rises sharply giving an off resistance of around 300 MΩ.

The FOD3180 is another variant from Fairchild; it is a high speed MOSFET gate driver optocoupler which has additional load supply voltage connections. It is capable of switching 2 A at 250 KHz. At this speed it is necessary to take precautions to suppress EMI generation generated in the load.

(080683-I)

## Internet link

www.toshiba.com/taec/components2/Datasheet_Sync//214/4495.pdf