Phototriacs
Frequently Asked Questions (FAQs)

1. Q: WHAT IS A PHOTOTRIAC?

A: Phototriacs are solid-state AC switches which consist of an LED on the input and two thyristors, connected to a TRIAC, on the output. The light emitted from the LED triggers the output making it conductive.

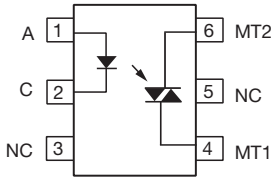


Fig. 1 - Example of a 6-Pin Phototriac

2. Q: WHAT ARE THE ADVANTAGES OF PHOTOTRIACS AS SWITCHES?

A: Some of the advantages of phototriacs are their solid-state reliability, the elimination of contact bouncing and contact arcing, their small size and the isolation of the high-voltage output from the triggering input.

3. Q: WHAT ARE THE MOST COMMON APPLICATIONS FOR PHOTOTRIACS?

A: Phototriacs are mostly used in applications such as AC switches, as drivers for a power TRIAC or are also used as DC latches in unique applications.

4. Q: WHICH DIFFERENT TYPES OF PHOTOTRIACS ARE AVAILABLE?

A: There are 2 different types of phototriacs whereby the output is triggered either in a zero-crossing or non-zero crossing mode. In case of non-zero crossing (NZC) phototriacs, there is no zero-crossing detection and the output turns on immediately when the input signal triggers. They are suitable for phase angle independent control and can be used in applications such as light dimmers or motor control.

On the other hand, the zero crossing (ZC) phototriac output is only activated when the AC load voltage crosses the zero point. The zero-detection circuitry inhibits the output to turn on first when the voltage is below a certain value, almost “zero”. These phototriacs can be used in applications such as heater control or solenoid drivers as well as light dimmers whereby the current and voltage spikes resulting in electromagnetic interference (EMI) and radio frequency interference (RFI) should be minimized and a snubber network should or must be avoided. Have a look into the application note for more details: www.vishay.com/doc?84780

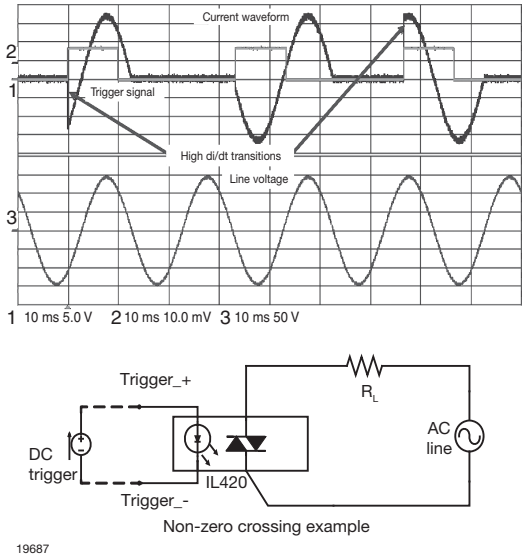


Fig. 2 - Non-Zero Crossing Example

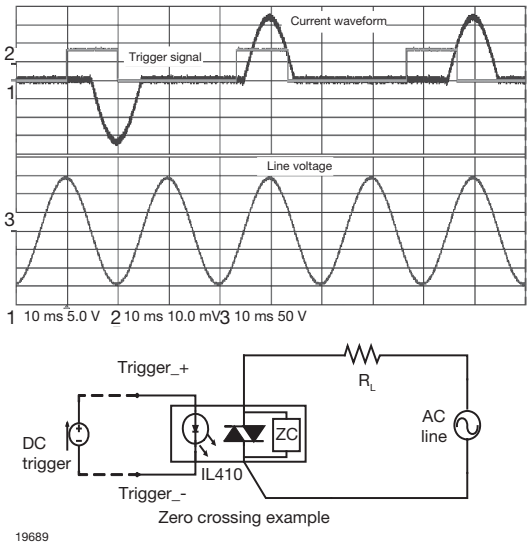


Fig. 3 - Zero Crossing Example

5. Q: WHICH PARAMETERS DETERMINE THE TRIGGER DELAY?

A: The trigger delay is a function of trigger current (I_{FT}) and temperature (T_{amb}). For a faster turn-on time, more trigger current is necessary. The trigger delay increases with higher temperature. Have a look into the application note for more details: www.vishay.com/doc?84780

6. Q: WHICH FACTORS SHOULD BE CONSIDERED WHEN DETERMINING THE PERMISSIBLE LED CURRENT?

A: The trigger current (I_{FT}) is shown in the datasheet. The forward voltage drop across the LED can be calculated using the V_F vs. I_F graphs from datasheet. The maximum allowable power dissipation for different temperatures should be taken into account when establishing the LED current. Finally, LED degradation due to aging should also be considered. Have a look into the application note for more details: www.vishay.com/doc?84780

7. Q: WHAT IS THE BLOCKING VOLTAGE (V_{DRM}) OF A PHOTOTRIAC?

A: The output parameter “blocking voltage” or “peak-off state voltage” (V_{DRM}) of a phototriac is the maximum voltage that can be applied across the output of the device without damaging it and which should not be exceeded.

8. Q: WHAT IS THE OFF STATE CURRENT ($I_{D(RMS)}$) OF A PHOTOTRIAC?

A: The off state current $I_{D(RMS)}$ is the leakage current that will pass the device in its off-state.

9. Q: WHAT IS THE HOLDING CURRENT (I_H) OF A PHOTOTRIAC?

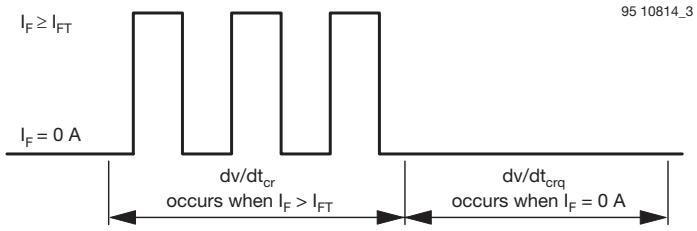
A: After being triggered on, phototriacs will conduct even without the trigger signal until the current through the device drops below a certain value. The holding current I_H shows how much current is required to keep the phototriac in its conducting mode.

10. Q: WHAT IS THE INHIBIT VOLTAGE (V_H) OF A PHOTOTRIAC?

A: The inhibit circuit of zero crossing triacs prevents the triac from being triggered on when the load voltage is below the inhibit voltage ratings even if the trigger current (I_{FT}) is high.

11. Q: WHAT ARE THE “STATIC dv/dt” AND “COMMUTATING dv/dt”?

A: Static dv/dt is the rated parameter of rise in voltage without any triggering signal $I_{(FT)}$. Exceeding this parameter will lead the phototriac to be triggered on, however it will turn off again at the next zero crossing of the load voltage.
Commutating dv/dt rating should be taken into consideration when the forward current is changing. When the load voltage and current are not in phase with each other and the phototriac tries to turn off at zero current, the triac might turn on again due to a sudden rise in the voltage which exceeds the commutating dv/dt rating. For a successful turn-off, the current should drop at a rate slow enough to prevent the device from retriggering on. Have a look into the application notes for more details: www.vishay.com/doc?84791



dv/dt_{cr} Highest value of the “rate of rise of off-state voltage” which does not cause any switching from the off-state to the on-state
dv/dt_{crq} Highest value of the “rate of rise of communicating voltage” which does not switch on the device again, after the voltage has decreased to zero and the trigger current is switched from I_{FT} to zero

Fig. 4 - Graphic Explanation of Static and Commutating dv/dt

12. Q: HOW CAN FALSE TRIGGERING BE AVOIDED?

A: The first solution is to choose a phototriac that can withstand higher dv/dt transitions (such as Vishay IL410 or IL420 with ratings as high as 10 000 V/µs).
The second solution is to apply an additional snubber circuit in the application to reduce the dv/dt seen by the phototriac. Have a look into the application note for more details: www.vishay.com/doc?84791

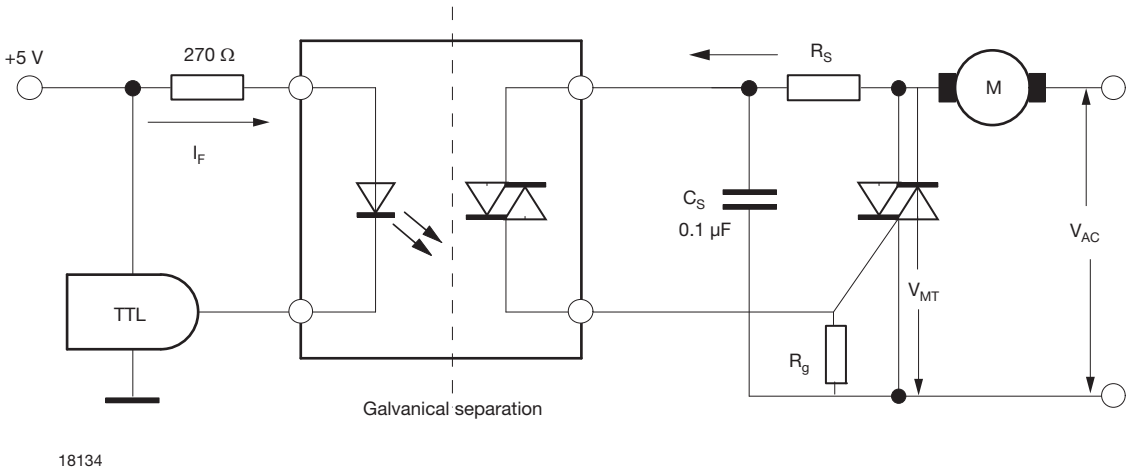


Fig. 5 - Example of a Driver Application With a Phototriac and Snubber Circuit

13. Q: WHEN IS IT REQUIRED TO USE A PHOTOTRIAC AS POWER TRIAC DRIVER?

A: Due to the limited power dissipation of the small package, the current handling capability of phototriacs are in the ranges of 100's of mA. However, in many TRIAC applications currents in the range of several amps are required. In such cases, phototriacs are used in combination with high power TRIACs. Phototriacs are applied as TRIAC drives which provide the gate current and isolation required. (Fig. 5)

14. Q: I DO NOT HAVE ENOUGH BOARD SPACE FOR A POWER TRIAC BUT I NEED MORE CURRENT?

A: Vishay offers a special product series where a power TRIAC is already included. It comes in a small and board space saving DIP-8 package. Part names are VO2223A (www.vishay.com/ppg?81924) and VO2223B (www.vishay.com/ppg?83312) with enhanced dv/dt parameter.

15. Q: WHICH VISHAY PHOTOTRIAC OFFERS THE HIGHEST dv/dt PERFORMANCE?

A: Vishay offers industrie's leading 10 kV/µs performance TRIACs. Recommended for zero crossing is the IL410 product family (www.vishay.com/ppg?83627, www.vishay.com/ppg?83628) and the non-zero crossing IL420 product family (www.vishay.com/ppg?83629, www.vishay.com/ppg?83630)