DID YOU KNOW?

THE SWITCHING SPEED OF PHOTODIODES IS INFLUENCED BY THREE KEY PARAMETERS

Often, the switching speed of a photodiode is a key parameter that defines the response time of an overall system. Therefore, you will always find the switching speed of photodiodes in Vishay's datasheets. However, this parameter is always specified under certain test conditions. For example, the rise and fall times of the VEMD5010X01 are 100 ns given a reverse voltage of 10 V, a load resistance of 1 kΩ, and a wavelength of 820 nm.

Basic characteristics (T_{amb} = 25 °C, unless otherwise specified)						
Parameter	**Test condition**	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**
Rise time	V_R = 10 V, RL = 1 kΩ, λ = 820 nm	t_r		100		ns
Fall time	V_R = 10 V, RL = 1 kΩ, λ = 820 nm	t_f		100		ns

To assess the real behavior in a designer's application, one needs to consider the three key parameters that influence the switching speed of a photodiode. These parameters are: wavelength of the detected light, reverse voltage, and load resistance.

The basic dependencies are:

- The longer the wavelength, the slower the speed
- The higher the reverse voltage, the faster the diode
- The lower the load resistance, the faster the switching

A more technical way of putting it is that switching times are limited by carrier lifetime. Due to the absorption properties of silicon photodiodes, most of the incident light at longer wavelengths is absorbed outside the space charge region. Therefore, rise and fall times increase for wavelengths greater than 850 nm (Figure 1). On the other hand, a higher reverse voltage widens the space charge region, more charge carriers are generated inside the space charge region and the switching gets faster (Figure 2). Finally, the load resistance can be used to adjust the switching speed. A lower resistance simply leads to a smaller RC time constant (τ). With τ = *RC*, it becomes clear that a low resistance facilitates a fast response (Figure 2).

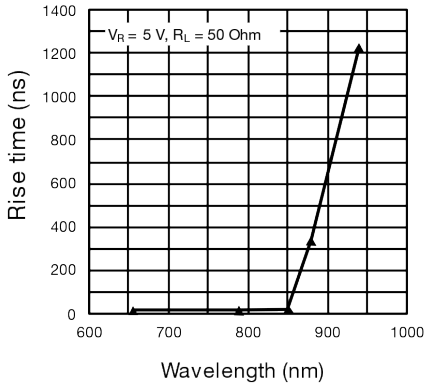

Figure 1. Switching Times vs. Wavelength for Photodiode VEMD6010X01

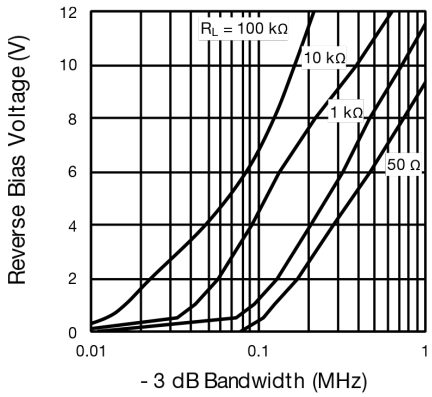

Figure 2. VEMD5010X01 Bandwidth vs. Reverse Bias Voltage, Parameter: Load Resistance, λ = 940 nm

In terms of Vishay's photodiodes, our VEMDxx60X01 product series offers the fastest switching times, as these are trimmed to serve high speed applications.

Vishay manufactures PIN photodiodes in different packages, sizes, and technologies. Click the link for more information: http://www.vishay.com/photo-detectors/pin-photo/.