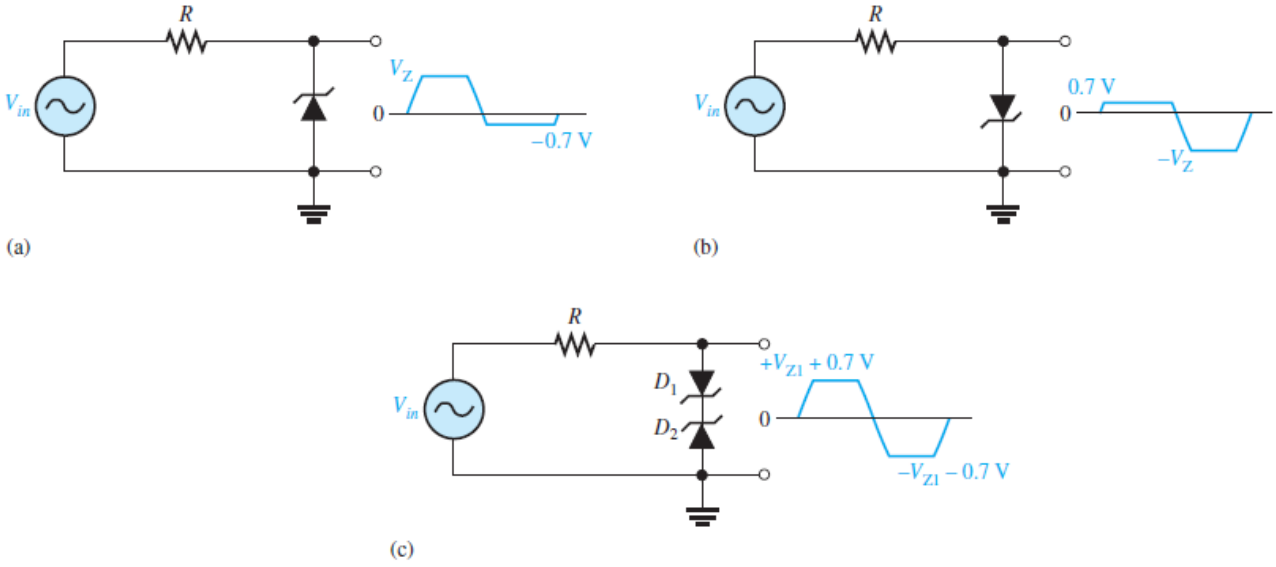
(3) Zener Limiter

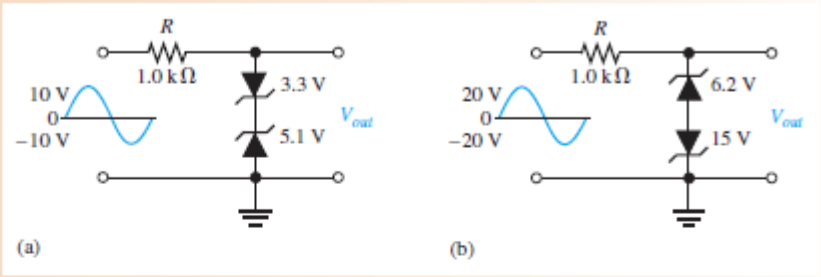
In addition to voltage regulation applications, zener diodes can be used in ac applications to limit voltage swings to desired levels.



▲ FIGURE 3–18

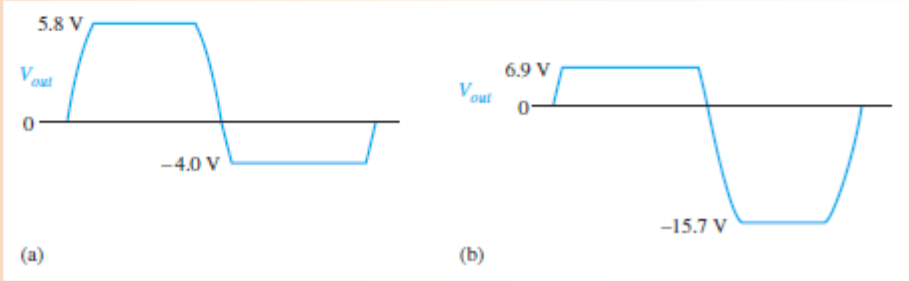
Basic zener limiting action with a sinusoidal input voltage.

EXAMPLE 3–8 Determine the output voltage for each zener limiting circuit in Figure 3–19.

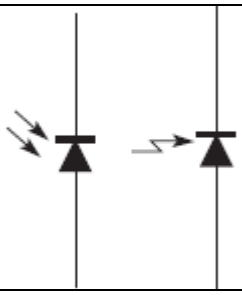


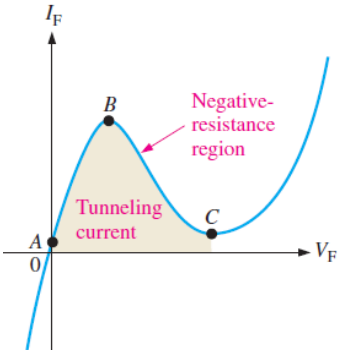
▲ FIGURE 3–19

Solution See Figure 3–20 for the resulting output voltages. Remember, when one zener is operating in breakdown, the other one is forward-biased with approximately 0.7 V across it.



Other Special Purpose Diodes

Diode Name	Description	Applications	Symbol
Varactor Diode	• The depletion region acts as a capacitor dielectric. • The *p* and *n* regions are conductive and act as the capacitor plates. • Operates in reverse bias • As the reverse-bias voltage increases, the depletion region widens, increasing the plate separation, thus decreasing the capacitance.	Tuning circuits (parallel resonant circuits) in communication systems	
Light Emitting Diode (LED)	• Operates in forward bias • Recombining of electrons with holes release energy as photons (Electroluminescence) • Example: GaAs LED which gives IR light.	• 7-segment display • IR LED in industrial applications • LED displays • Traffic Lights	
Photo-Diode	• Operates in reverse bias • When exposed to light, the reverse current increases with the light intensity.	• CD players • Smoke detectors • TV receivers • Variable Resistor	
Laser Diode	• Operates in forward bias • Due to recombination, photons released which strike atoms and cause other photons to be released forming an intense beam of laser light.	• CD players • Laser printers • Fiber optic system	
Schottky Diode	• Formed by joining a doped semiconductor region (usually n-type) with a metal • When forwarded, the higher energy electrons in the n region are injected into the metal region where they give up their excess energy very rapidly, and a very rapid response to a change in bias occurs. • The Schottky is a fast-switching diode (low V_F)	• High switching applications • Digital circuits	

PIN Diode	• When **reverse-biased**, the pin diode acts like a nearly constant capacitance. • When **forward-biased**, it acts like a current-controlled variable resistance. • Contains intrinsic (not doped) semiconductor region.	• Used as a dc-controlled microwave switch. • Modulating device because of changing R.	
Tunnel Diode	• Special characteristic: Negative Resistance. • Heavy doping  A to B: acts as conductor B to C: negative resistance region C: Conventional diode	• Useful in oscillator • Useful in microwave amplifiers • Parallel resonant circuit RLC