

## Other diode types

Kizito NKURIKIYEYEU, Ph.D.

# Zener diode

- In the breakdown region, the  $i$ - $v$  curve has a step curve and a near constant voltage drop (Fig. 1)
- This behavior is used to make voltage regulator<sup>1</sup>
- Zener diodes—also called breakdown diodes are specifically manufactured to operate in the breakdown region<sup>2</sup>.

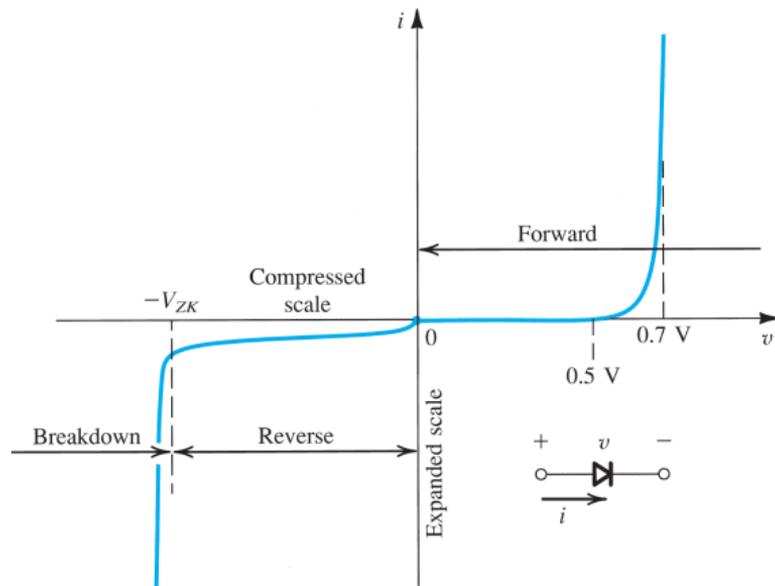


FIG 1. The diode  $i$ - $v$  relationship

<sup>1</sup> A voltage regulators are circuits that provide a constant dc output voltage irrespective of changes in their load current and power-supply voltage. See [https://en.wikipedia.org/wiki/Voltage\\_regulator](https://en.wikipedia.org/wiki/Voltage_regulator)

<sup>2</sup> Zener diodes have been virtually replaced in voltage-regulator design by specially designed integrated circuits that perform the voltage-regulation function much more effectively and with greater flexibility than zener diodes.

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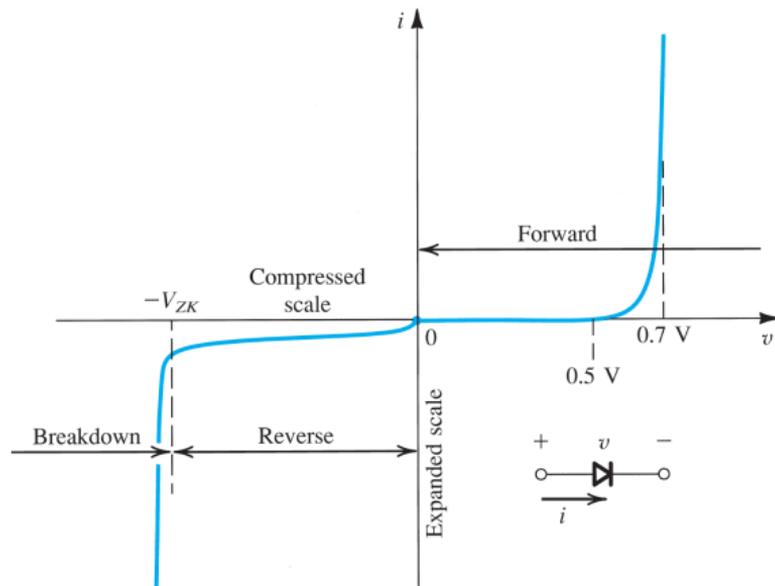


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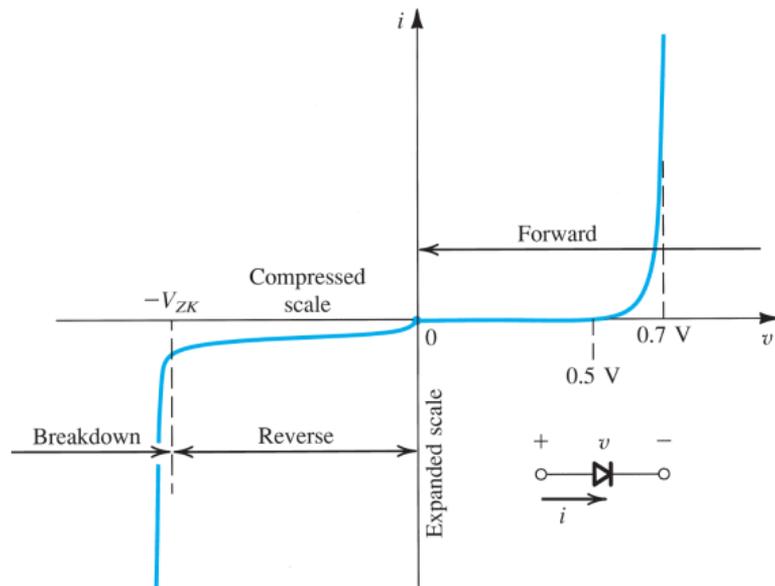


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- Zener diodes provide a specified breakdown voltage  $V_{Z0}$ .
- Note that although the breakdown voltage is on the negative voltage axis (reverse-bias), its value is given as a positive quantity.
- Fig. 2 shows a circuit symbol of a Zener diode

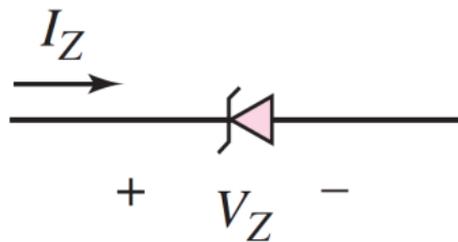
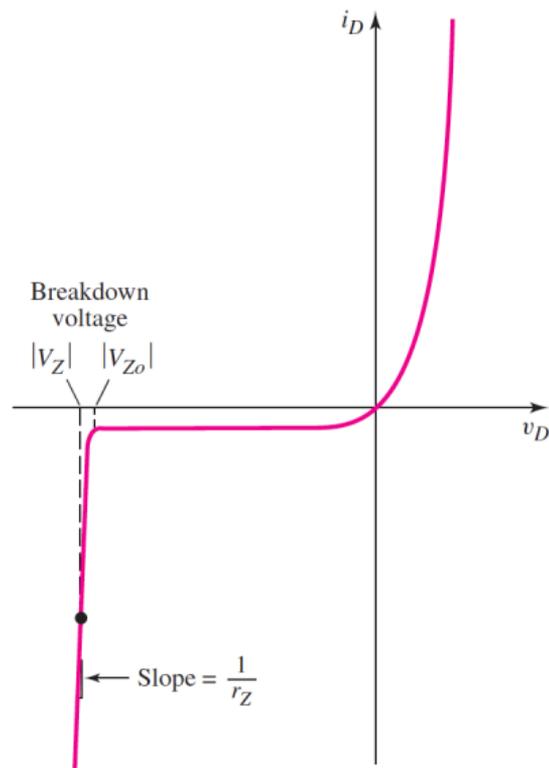


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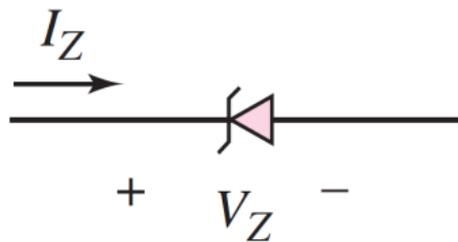
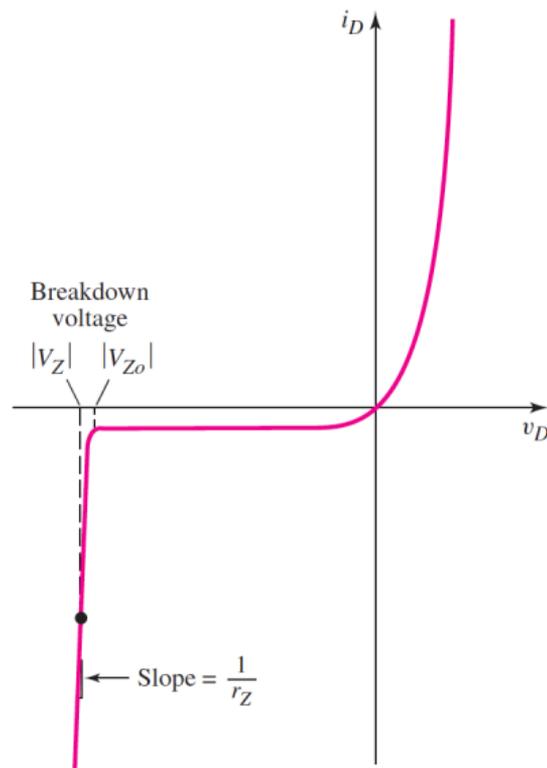
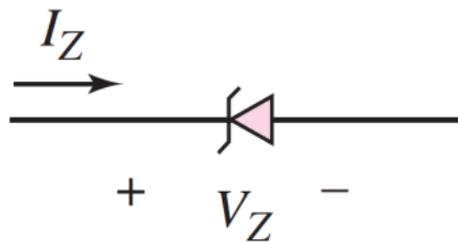


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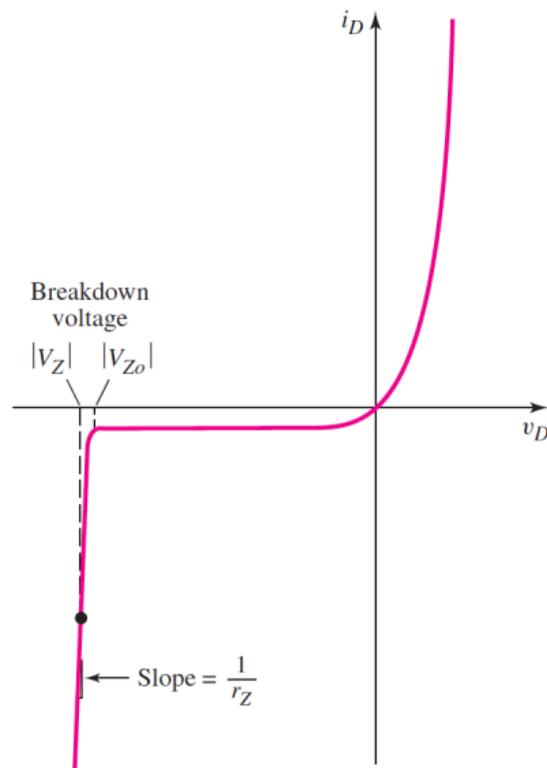


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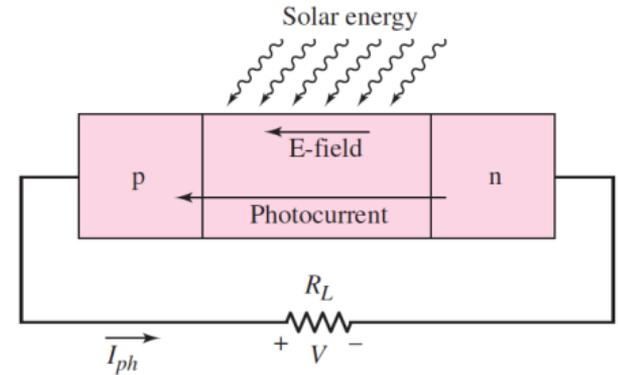


**FIG 2.** Circuit symbol of the Zener diode



# Solar Cell

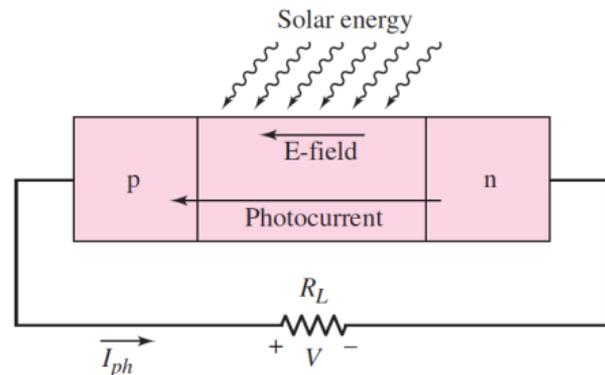
- solar cell is a pn junction device with no voltage directly applied across the junction.
- The pn junction, which converts solar energy into electrical energy, is connected to a load
- When light hits the space-charge region, electrons and holes are generated. They are quickly separated and swept out of the spacecharge region by the electric field, thus creating a photocurrent.
- The generated photocurrent will produce a voltage across the load, which means that the solar cell has supplied power.



**FIG 4.** A pn junction solar cell connected to load

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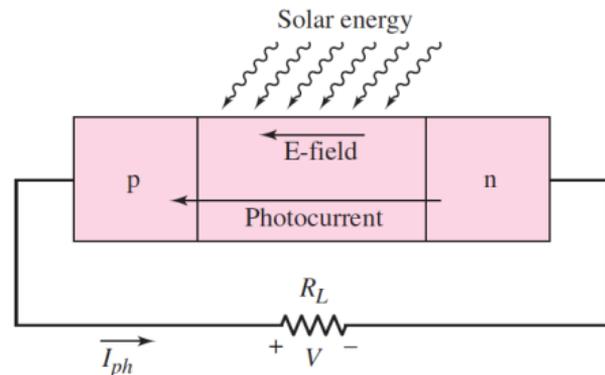
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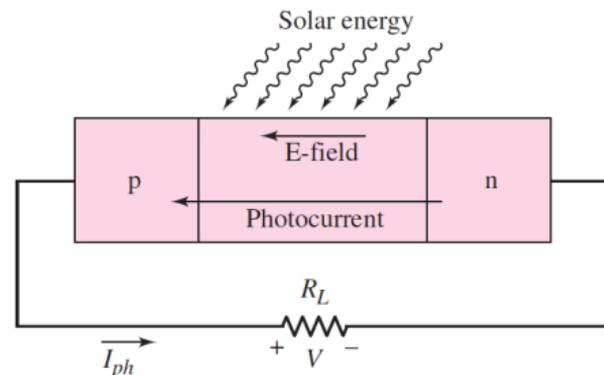
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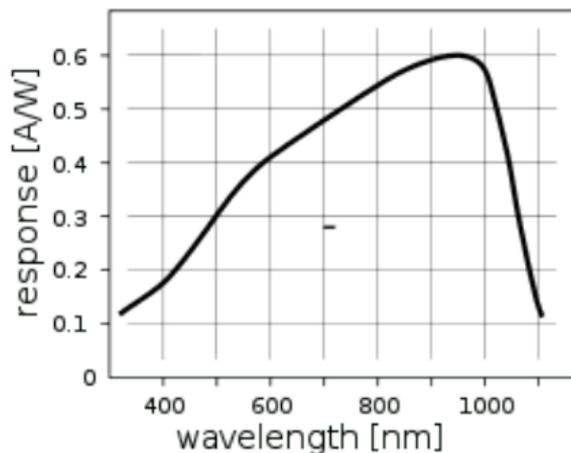
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# Photodiode

- Photodetectors convert optical signals into electrical signals.
- They are similar to a solar cell except that the pn junction is operated with a reverse-bias voltage.



(a) A photodiode



(b) Response of a photo diode vs wavelength of the incident light

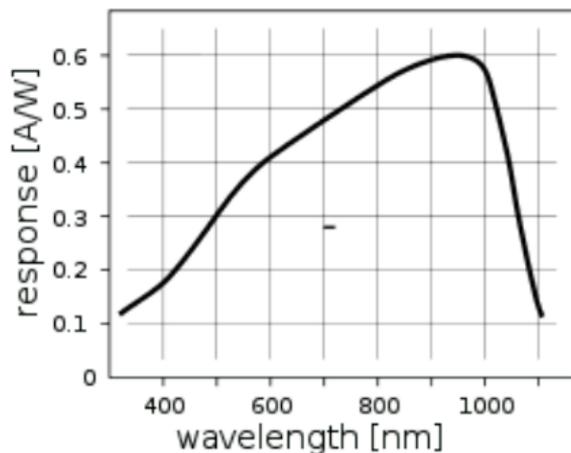
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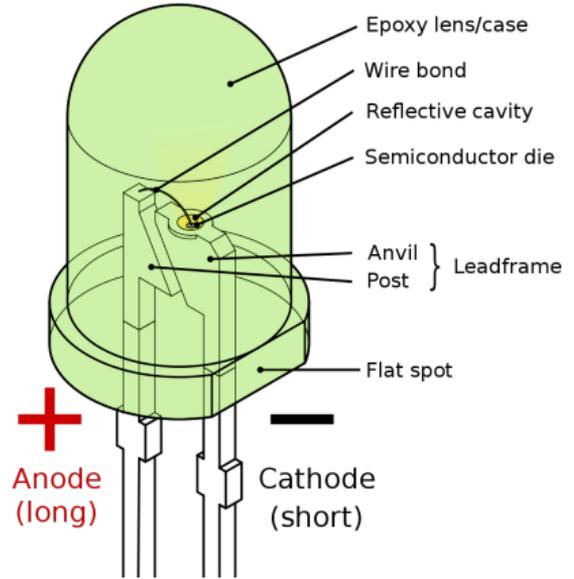


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# Light-Emitting Diode

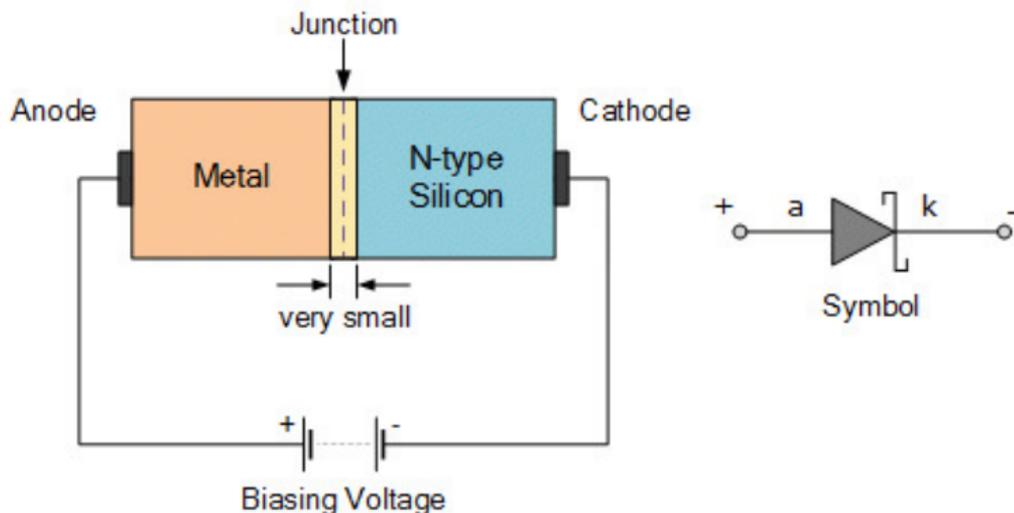
- The light-emitting diode (LED) converts current to light



<sup>1</sup> [https://en.wikipedia.org/wiki/Light-emitting\\_diode](https://en.wikipedia.org/wiki/Light-emitting_diode)

# Schottky diode

- The Schottky Diode is a type of metal-semiconductor diode having a low forward voltage drop and a very fast switching speed



- Schottky diodes are used in rectification, signal conditioning and switching, through to TTL and CMOS logic gates due to their low power and fast switching speeds.

<sup>1</sup> <https://www.electronics-tutorials.ws/diode/schottky-diode.html>

**The end**