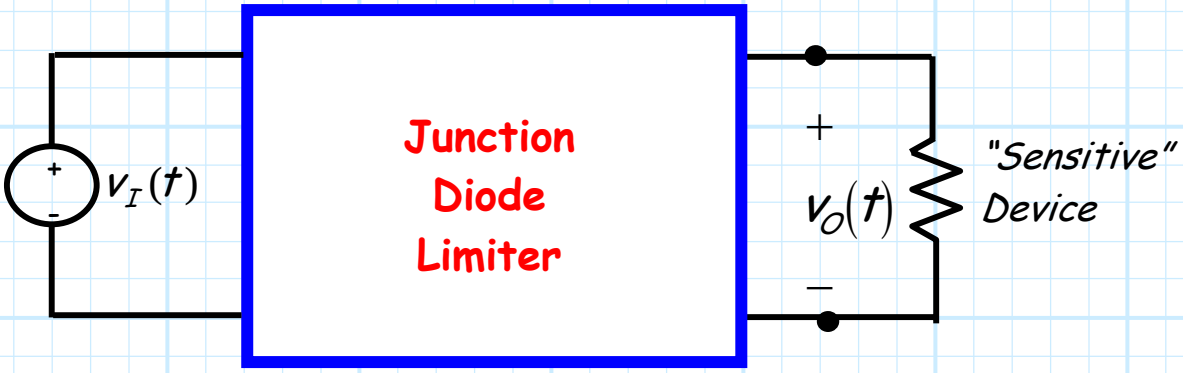
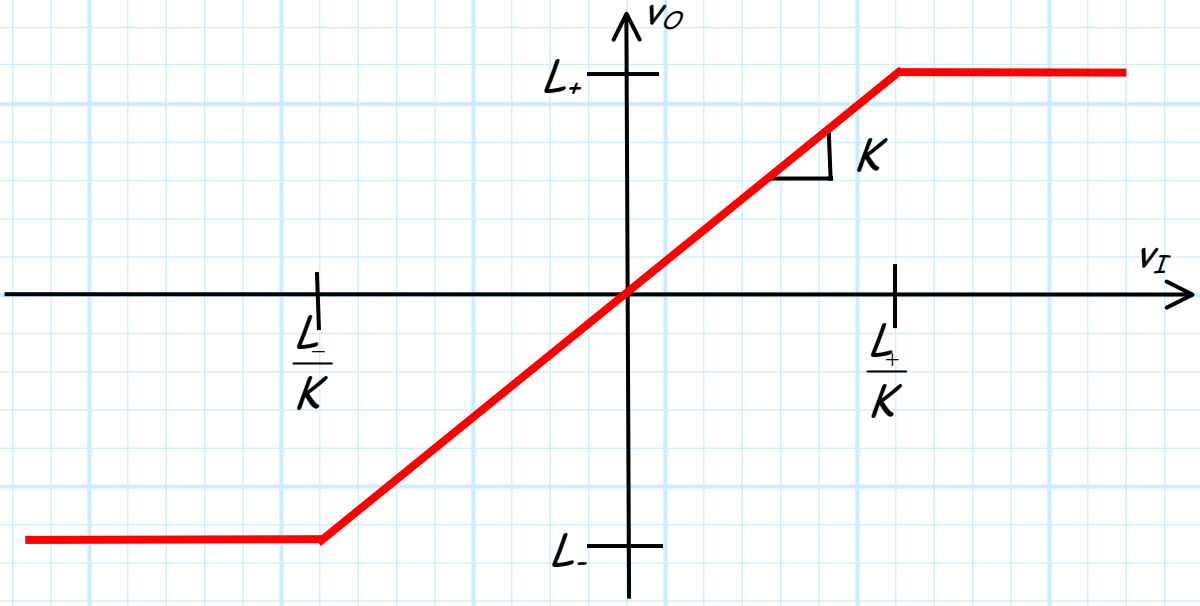
Diode Limiters

Often, a voltage source (either DC or AC) is used to supply an electronic device that is very **expensive** and/or very **sensitive**.

In this case, we may choose insert a **diode limiter** between the source and the device—this limiter will provide **over-voltage protection** !

To see how, we should first consider a typical **transfer function** for a junction diode limiter:





Note that this transfer function indicates that the **output** voltage v_O can **never** be more than a **maximum** voltage L_+, nor less than a **minimum** voltage L_-.

Thus, the device places some **limits** on the value of the **output** voltage:

$$L_- < v_O < L_+ \qquad \text{for any} \quad v_I$$

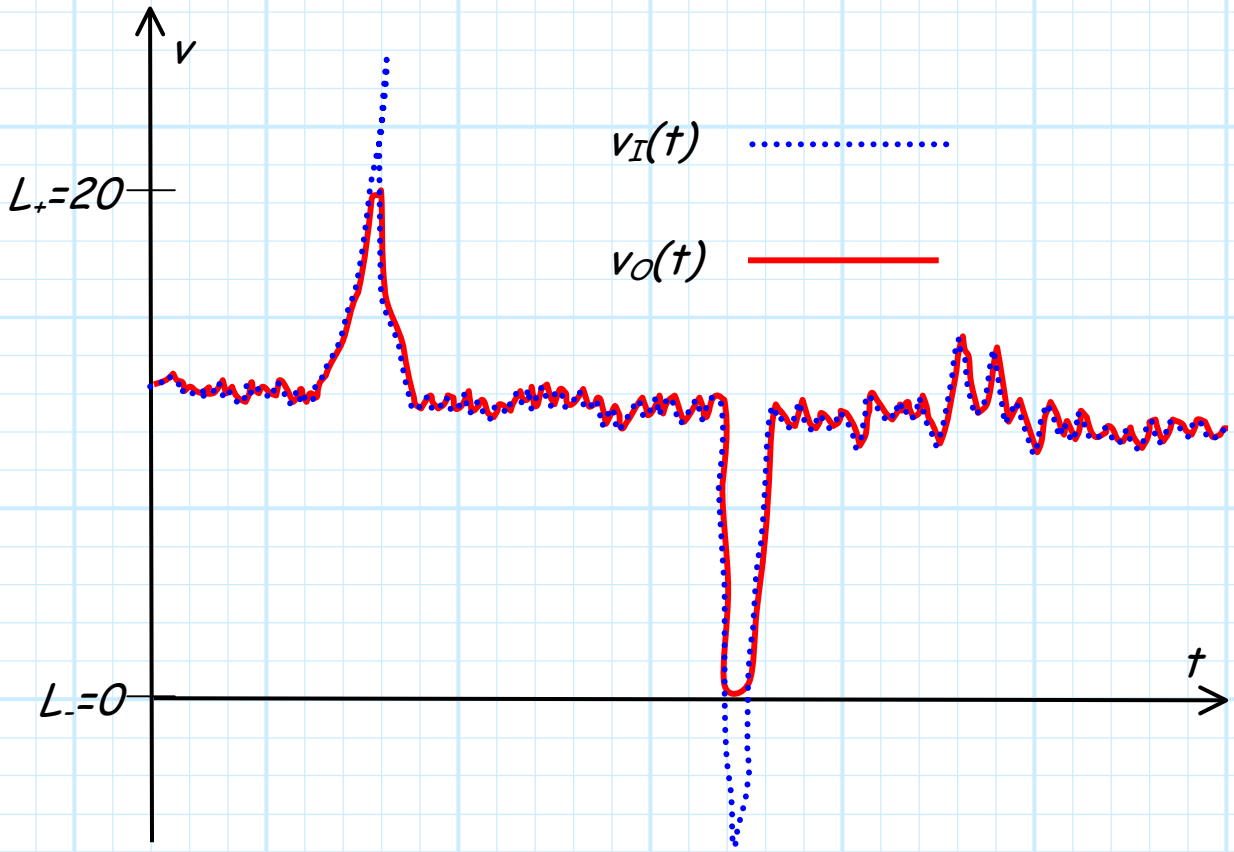
The limits L_- and L_+ provide a **safe** operating value for v_O, the voltage across our "sensitive" electronic device.

Presumably, if **no limiter** were present, we might find that $v_O > L_+$ or $v_O < L_-$, resulting in **damage** to the device!

Note although $L_+ > L_-$, the values of L_- and L_+ may be both **positive**, both **negative**, or even **zero**.

For example, a limiter with $L_- = 0$ (L_+=0) would prevent the voltage from ever becoming **negative** (positive). We find that for many devices, the **wrong** voltage **polarity** can be **destructive**!

To illustrate, let's consider an **example** input voltage v_I(t), and the resulting output voltage when passed through a **limiter** with values L_-=0 and L_+=20 V (K=1).



Note there are a couple of "**hiccups**" in the **input** voltage that take the voltage value **outside** the "safety" range of the sensitive device. However, the limiter does in fact **limit** these excursions, such that the voltage across the sensitive device **always** remains between 0 and 20 Volts.

Q: *Why would these "hiccups" occur?*

A: There are **many** possible reasons, including:

1. A power **surge** (e.g., lightning strike)
2. **Static** discharge
3. **Switching** transients (e.g., at power up or down).

Perhaps the most **prevalent** reason, however, is **operator error**.

→ Someone connects the **wrong** source to the sensitive device!

Thus, limiters are often used on expensive/sensitive devices to make them "**fool-proof**".

Your book has many **examples** of limiter circuits, including: