LEDs

(Light Emitting Diodes)

Types and Uses

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Light Emitting Diodes

Definition

- Commonly called LEDs.
  - Found every where
- Basically, LEDs are like tiny light bulbs that fit easily into an electrical circuit.
- Unlike ordinary incandescent bulbs, they don't have a filament that will burn out, and they don't get especially hot.
- Illuminated solely by the movement of electrons in a semiconductor material
- They last just as long as a solid state device.

Light Emitting Diodes

Definition (cont.)

- The lifespan of an LED surpasses the short life of an incandescent bulb by thousands of hours.
- Tiny LEDs are already replacing the tubes that light up LCD HDTVs to make dramatically thinner televisions.
- They are rapidly replacing incandescent and fluorescent bulbs in household lighting.

Summarized from howstuffworks.com

Light Emitting Diodes

Background

- Special type of Diode that can emit light of varying colors depending on the chemical composition.
- Originally infra red was the predominant color, but engineers tinkered with the formula over time and have produced a rainbow of visible colors
- For a long time white was difficult and initially was a bluish color.
- Differ from incandescent blubs in that they are current devices not voltage.

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Some Facts --

- With an incandescent bulb, increasing the voltage increases the brightness.
- An LED will work with a range of voltage and the brightness is controlled by a current limiting resistor.
- Reducing the current will decrease the brightness.
- LEDs need a resistor or they become a small, bright flashbulb!
- LEDs are polarity sensitive. Hooking them up backwards normally won't damage them, just reverse the wires if they don't light. This can be addressed by using a small Bridge Rectifer.

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Some Facts – (cont.)

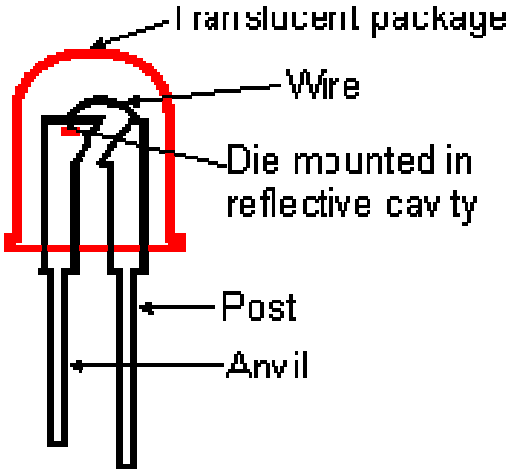
- LEDs are polarity sensitive and operate on low voltage DC.
- Most are rated starting at 2.5 volts, but can work up to higher voltages with a suitable current limiting resistor.
- Most have a reverse voltage that is less than the forward voltage.
  - Reverse voltage is when they are hooked up with the polarity reversed.
  - Generally not a problem for short periods.

Light Emitting Diodes

Two Types of LEDs of interest

Panel Mount, with built in lens

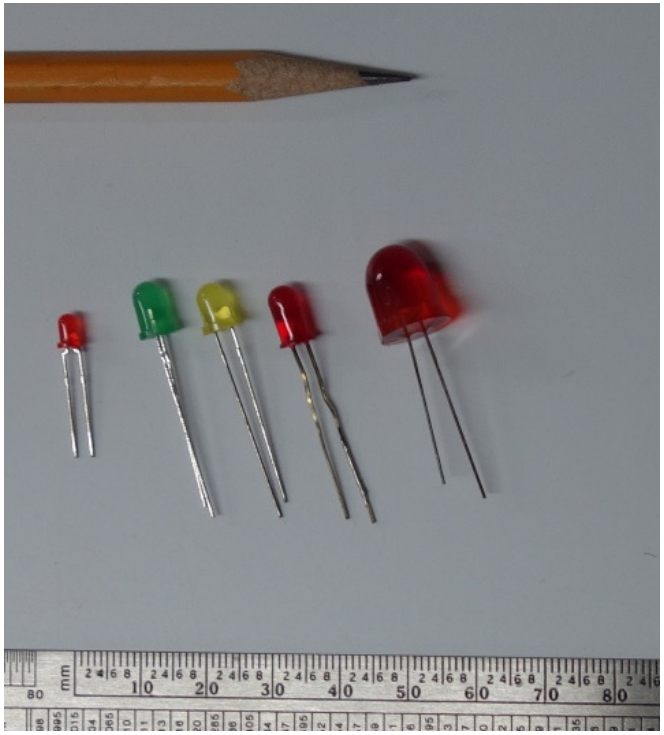
LEDs are available in a variety of package sizes. Possibly the most widely used is the 5mm diameter one, although a host of others are available ranging from 1.8mm, 3mm, 4mm, 8mm, 10mm and 20mm. There are also and rectangular LEDs available in almost any size to fit a wide variety of requirements.



Light Emitting Diodes

Some examples of the variety of sizes and some of the colors available in panel mount LEDs.

(Generally these can be used in signals and crossing flashers with the addition of a resistor and the proper power source.)



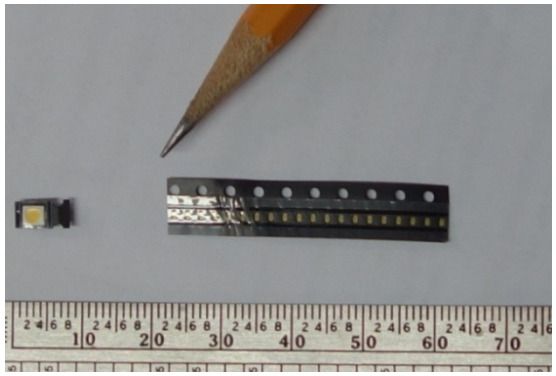
Light Emitting Diodes

Surface mount or SMT LED packages

LEDs are used in vast quantities on printed circuit boards. They are available in a variety of sizes from almost invisible to 6 mm^2 and larger. The ones we commonly use will be in the 6mm^2 and smaller.

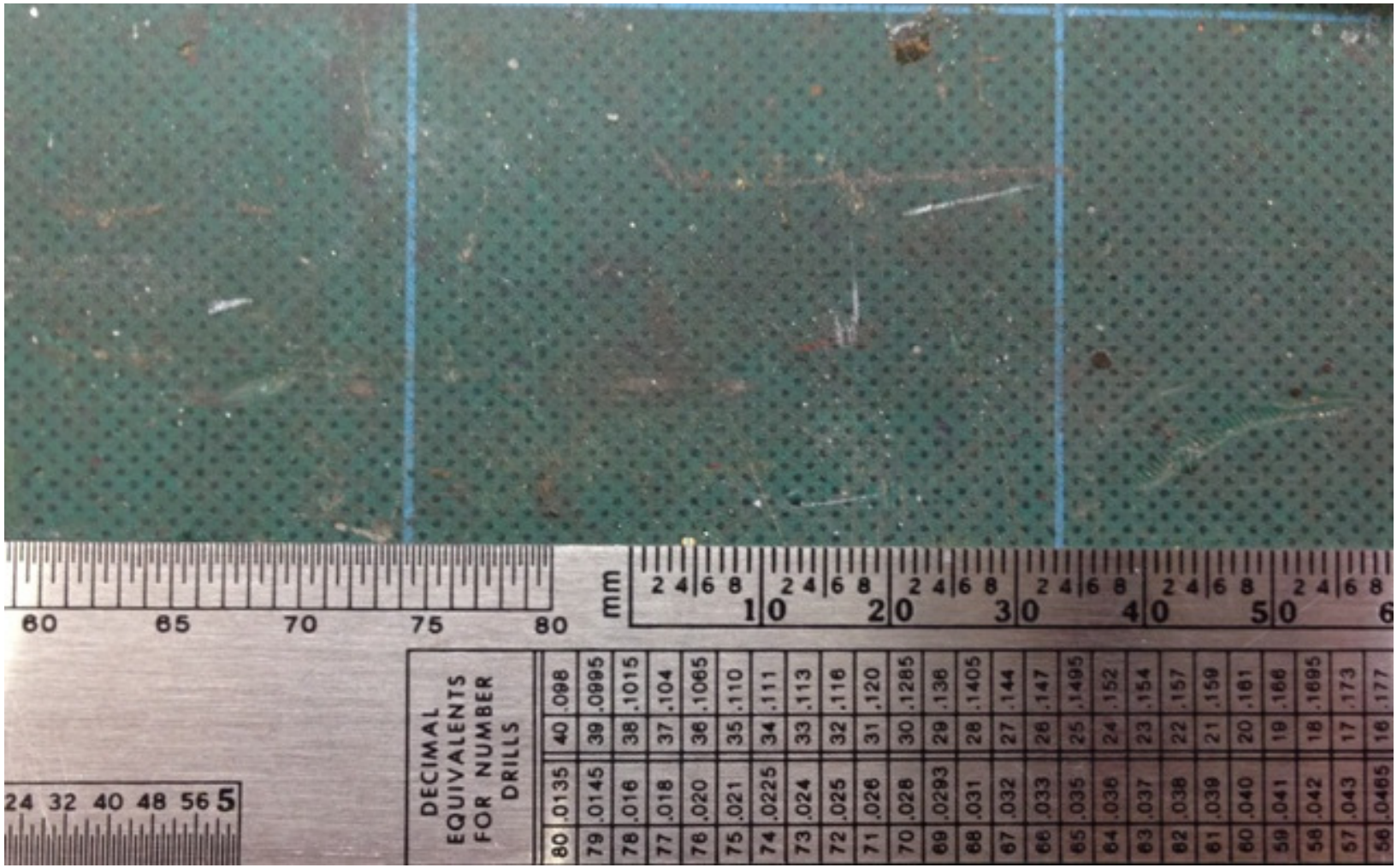
The most common LED SMT sizes with dimensions are given below.

Package designator	Length (mm)	Width (mm)	Height (mm)
1206	3.2	1.5	1.1
0805	2.0	1.25	0.8
0603	1.6	0.8	0.6
0402	1.0	0.5	0.45



Source: radio-electronics.com

Light Emitting Diodes



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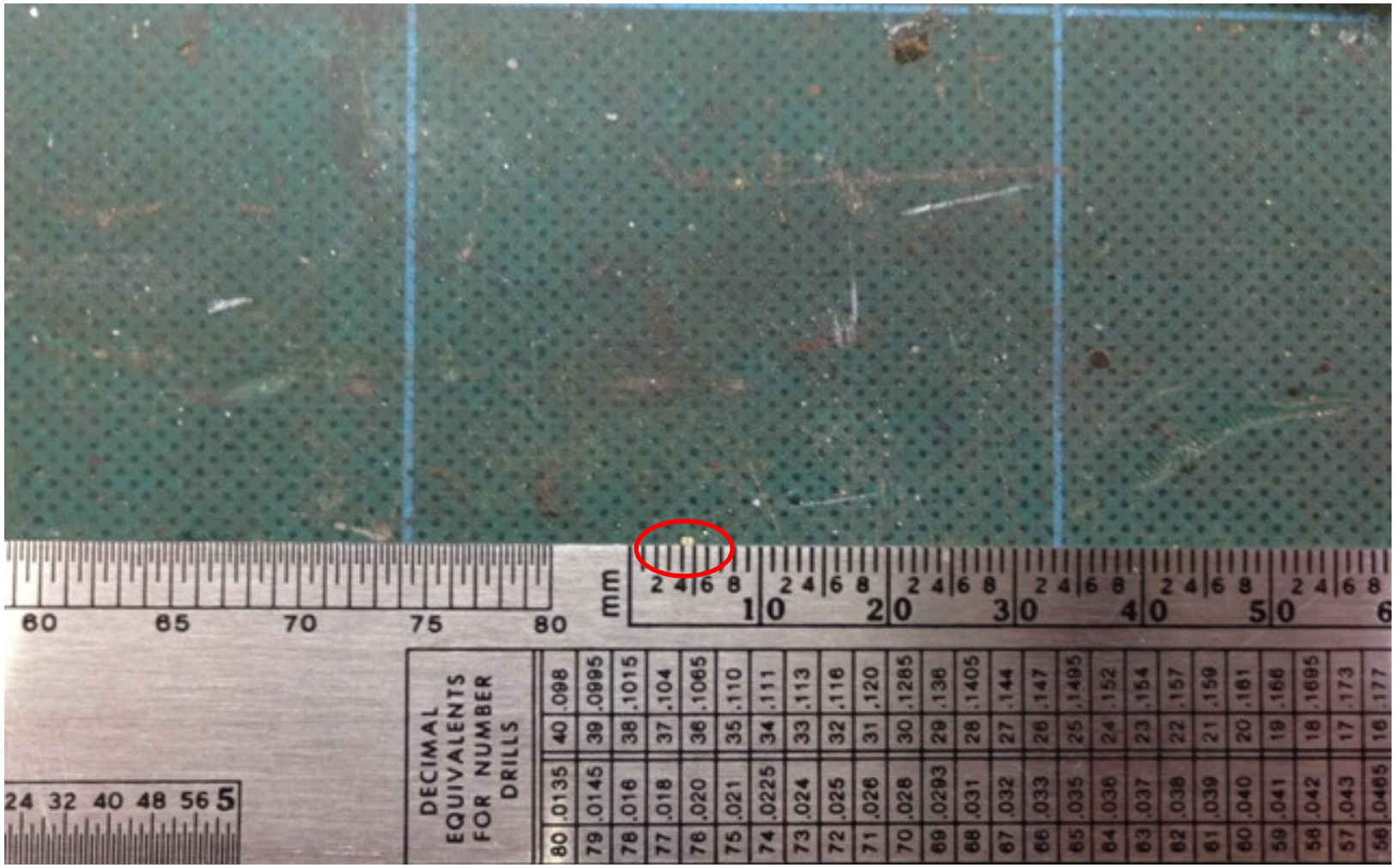

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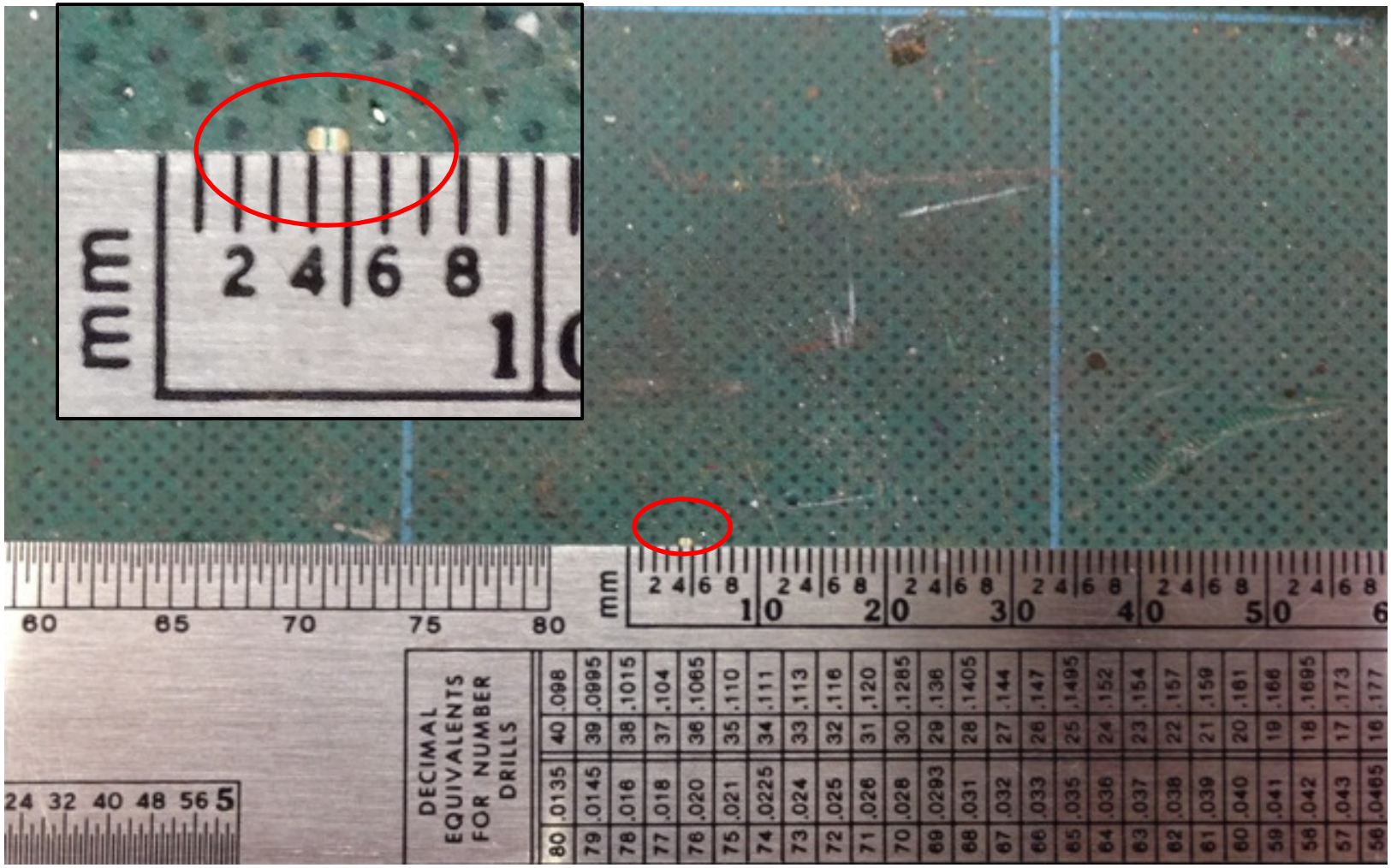
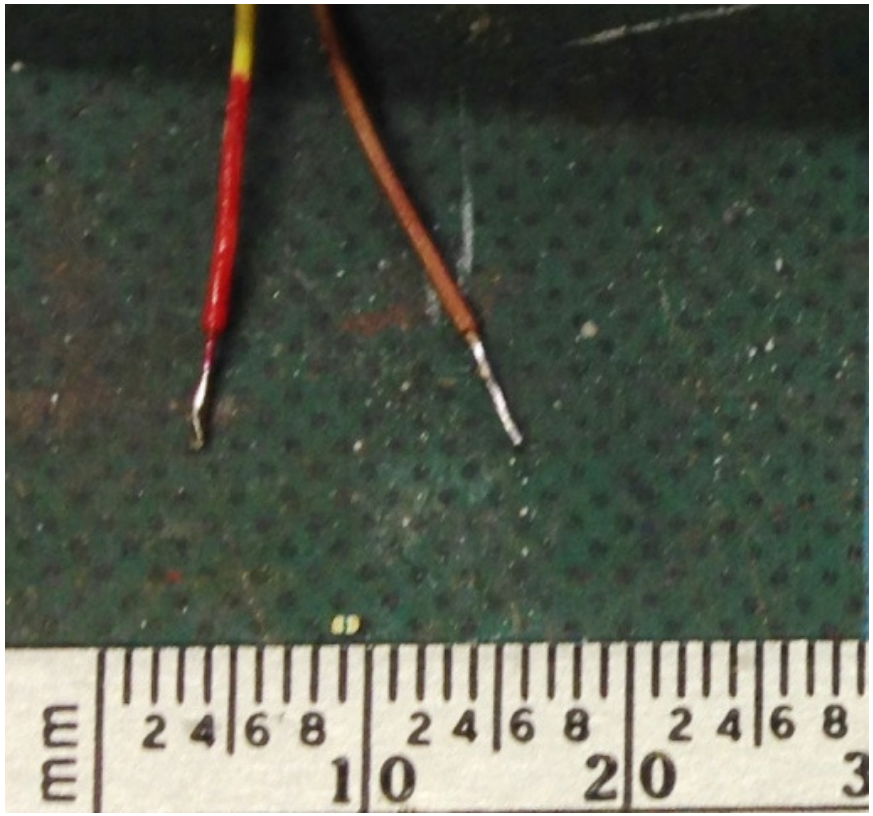


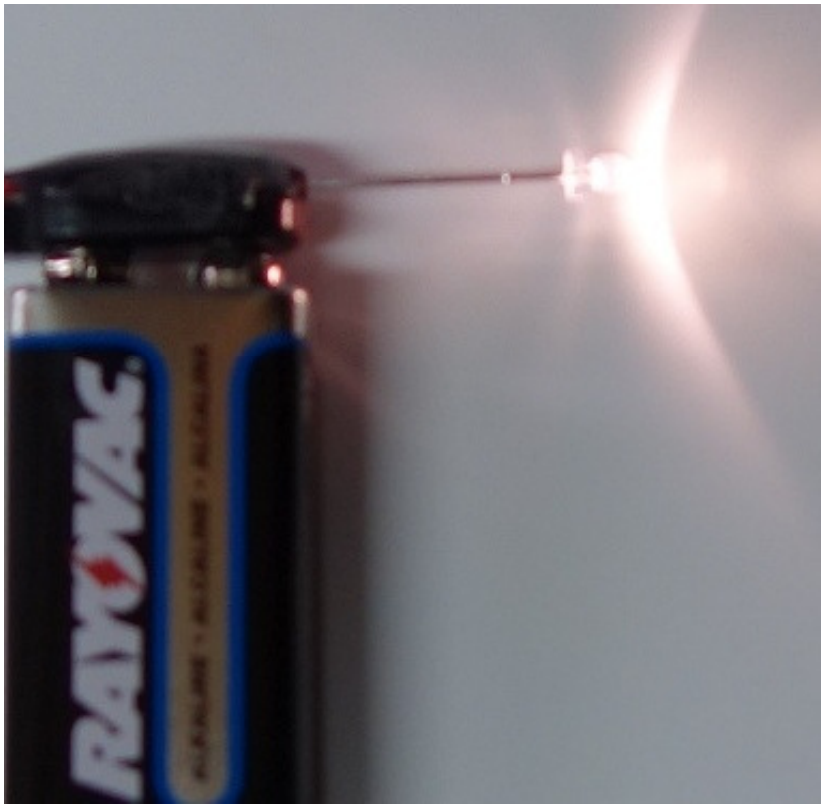
Light Emitting Diodes

Wiring LEDs

- As mentioned earlier, they are polarity sensitive devices.
- The long lead is the anode, or positive, and the short lead is the cathode, or negative, lead.
- For DCC lights the blue wire is positive and the convention is to install the current limiting resistor in that lead.
- For structures or other wiring it's best to settle on a convention so you know which is which after you trim the leads and/or attach the wires.

Light Emitting Diodes





Light Emitting Diodes

Many Uses:

- Headlights, Marker lights, Passenger car lights, etc.
- Structures; interior lighting, exterior lighting, signs, etc.

Tools & Supplies:

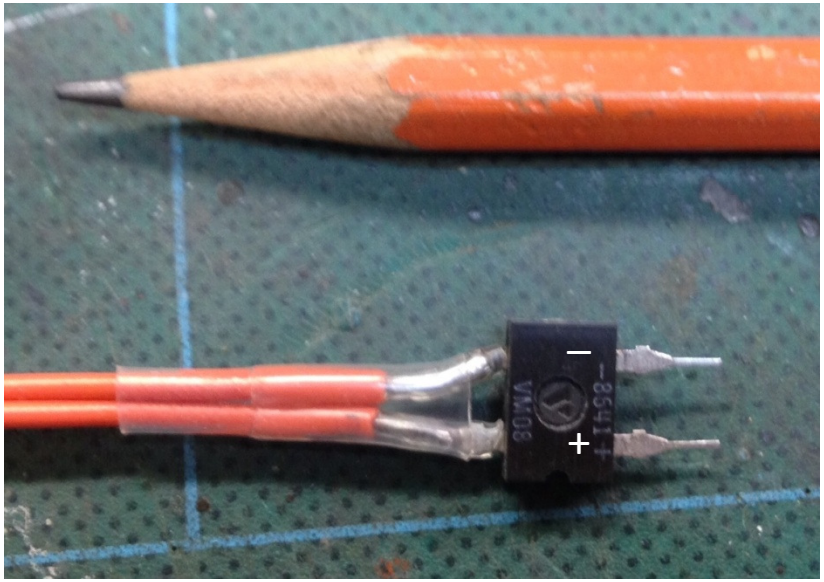
- Small soldering iron, 25-35Watt, with pointed tip.
- Resin, flux, Small diameter resin core solder.
- Wire cutters, strippers, tweezers
- LEDs
- Small shrink tubing, fine wire

Light Emitting Diodes

- Magnet wire can be used to connect to the “Nano” LEDs.
- Available in two colors from Ngineering.
- Any fine wire will work, but should be smaller than 30 ga.

Light Emitting Diodes

- Simple solution to polarity problem is to connect the LED to a small rectifier chip.
    - A Bridge rectifier converts AC to DCC. This means You can connect it to any source with a suitable voltage (7-19V AC, DC, or DCC)



Light Emitting Diodes

Demonstration:

Light Emitting Diodes

Some Sources: LED Baron

Woodland Scenics – Good assortment, easy to use, but relatively expensive. Available from Walthers and RC Hobby carries a good assortment in stock.

Evans Designs – Ohio company, usually sells at our train show, moderate prices.
http://www.modeltrainsoftware.com/led1.html

Super Bright LEDs – All kinds of LEDs and lights for every possible application.
https://www.superbrightleds.com

eBay sellers - LED Strip Lights and singles Reasonable prices for Quantity.
http://www.ebay.com/itm/5M-DC-12V-3528-5050-SMD-LED-300-LEDs-SMD-Flexible-LED-Roll-Strip-Light-/161643455017?var=&hash=item25a2b36229:m:mRnEQX8Sy-BIFM2EopycUlw

LED Baron -
http://www.ebay.com/itm/100-x-LED-SMD-0603-ultraflach-SUPER-GOLDEN-WHITE-LED-Litze-our-most-warm-white-/322084748804?hash=item4afdbf3e04

Sunshine-Model -
https://vod.ebay.com/vod/FetchOrderDetails?ViewPaymentStatus&purchaseOrderId=618429526010