

A decorative graphic on the left side of the slide, consisting of white and light blue lines and circles that resemble a circuit board or a network diagram. The lines are vertical and horizontal, with some branching out and ending in small circles.

# LED'S FOR MODELS AND LIGHTING

FORGET ABOUT BULBS

Metro-North Meeting

11/16/2024

Scott Russell

## HISTORY (THE BORING STUFF)

- LED's:
  - Infrared -1961
  - Red - 1962
  - Orange, Yellow and Green - 1967
  - Blue – 1972 – 1993
  - White - 1996

# LED'S FOR MODELS

- “Current” Device (Ratings like 10mA, 20mA)
- Semiconductor material that gives off light when forward current is applied
- Very efficient – 95% of the energy is converted to light instead of heat
- Forward Voltage is important rating to figure resistor value, and based on the quantum efficiency of the material, typically:
  - Red = 1.8v – 2.2v (GaP doped w/Zinc Oxide)
  - Yellow = 1.9v – 2.3v (GaP doped w/Nitrogen)
  - Green = 3.0v – 3.4v (GaP Pure)
  - Blue = 3.0v – 3.4v (InGaN)
  - White = 3.0v – 3.4v (InGaN + Phosphors)

## LED'S - SIZES

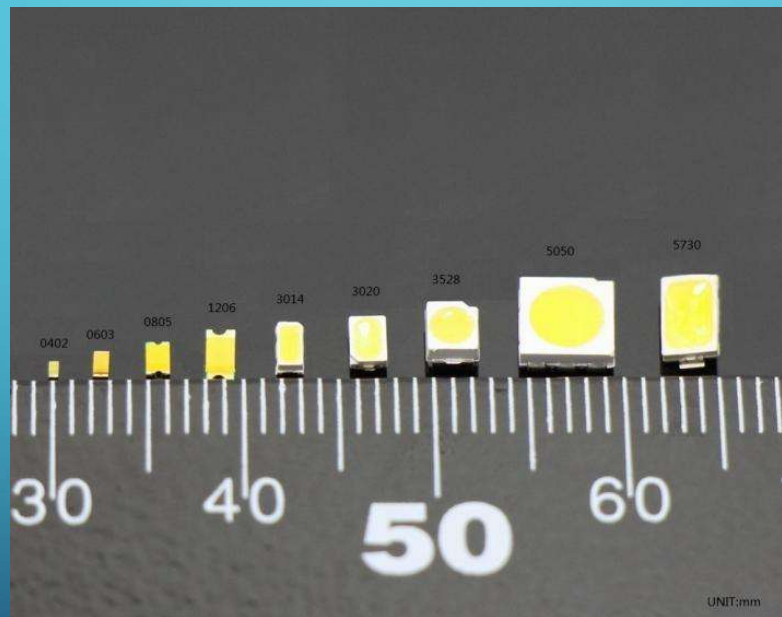
- T1 (3mm)
- T1  $\frac{3}{4}$  (5mm)
- Surface mount LED's are sized by rectangular dimensions. Common ones are:
  - 1206 .12" x .06" (3.2mm x 1.6mm)
  - 0805 .08" x .05" (2mm x 1.2mm)
  - 0603 .06" x .03" (1.6mm x .8mm)
  - 0402 .04" x .02" (1mm v .5mm)

## 3MM LED SHAPES

- Most common is the dome shaped, focused type:
- Flat top (Concave), wide angle, great for headlights:



# SURFACE MOUNT (SMD) LED'S - SIZES



# LED'S - CALCULATIONS

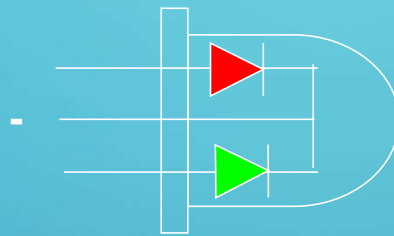
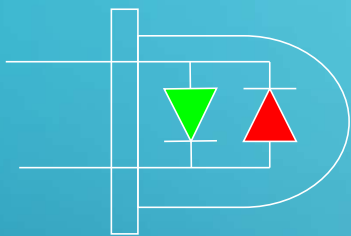
- $V$  = Power Supply Voltage (transformer, decoder, etc.)
- $V_F$  = LED Forward Voltage
- $I$  = LED Forward Current
- $R$  = Current Limiting Resistor
- $V - V_F = IR \rightarrow V - V_F / I = R$
- Example for White LED:  $12 - 3 = 9 / .010 = 900$  Use  $1K\Omega$  min,  $2K\Omega$  usually works

## BI-COLOR LED'S

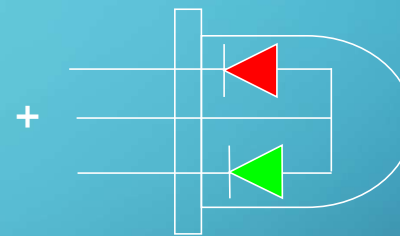
- Red / Green commonly used for Model RR use
- 2 lead: Red and Green chips are in reverse parallel (can be yellow on AC)
- 3 lead: Red and Green chips are either cathode to cathode (common -) or anode to anode (common +)
- Because Red is more efficient than Green, a balancing circuit is helpful



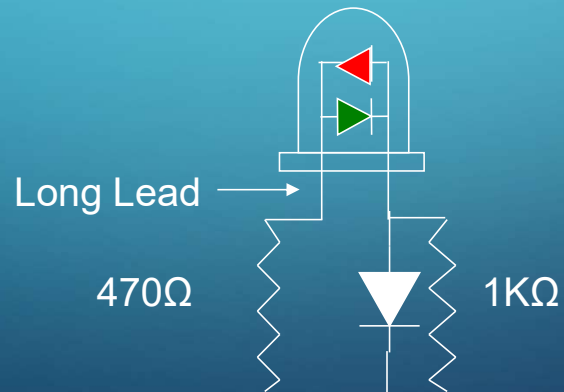
# BI-COLOR LED'S CONTINUED




Cathode to Cathode



Anode to Anode



# DO IT YOURSELF, OR:



Free Shipping on Domestic Orders of \$34 and up


888-764-2610  
help@modeltrainsoftware.com  
Mon-Fri: 9am - 5pm (MST)  
[Log in or Create account](#)

Search

HOBBY LEDS WIRE, SWITCH & MORE SIREN FOR DIECAST SOFTWARE GALLERY SUPPORT CART


## We have the Small, Tiny, Mini, and Micro LEDs for your Projects!

Please click any topic to learn more!



Using LEDs Videos

LEARN MORE




Click for Size Info

MEGA CHIP NANO PICO

More information about LED sizes


LEARN MORE



LED LIGHT FREQUENTLY ASKED QUESTIONS

LED FAQ

LEARN MORE



LED Gallery

LEARN MORE

< ● ● >

# LED'S FOR LAYOUT LIGHTING



## KELVIN VS. CELSIUS (MORE BORING STUFF)

- 0 degrees Celsius is the freezing point of water and 100 degrees is the boiling point.
- 0 degrees Kelvin is absolute zero (-273.15 Celsius)
- The degree increment is the same (1 degree K difference = 1 degree C difference).

# ROOM LIGHTING LED COLOR TEMPERATURE EXPRESSED IN DEGREES KELVIN



# COLOR TEMPERATURE VS. WORDED DESCRIPTION

- 1500 K – Candle
- 2700 K – Incandescent lamp (60W) LED “Warm White”
- 2800 K – Halogen lamp
- 3000 K – LED “Bright Warm White”
- 3500 K – LED “Natural White”
- 4000 K – Fluorescent lamp and LED “Natural White”
- 5300 K – LED “Daylight White” (High Proportion of Blue)



QUESTIONS?