LED'S FOR MODELS AND LIGHTING

FORGET ABOUT BULBS

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11/16/2024
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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

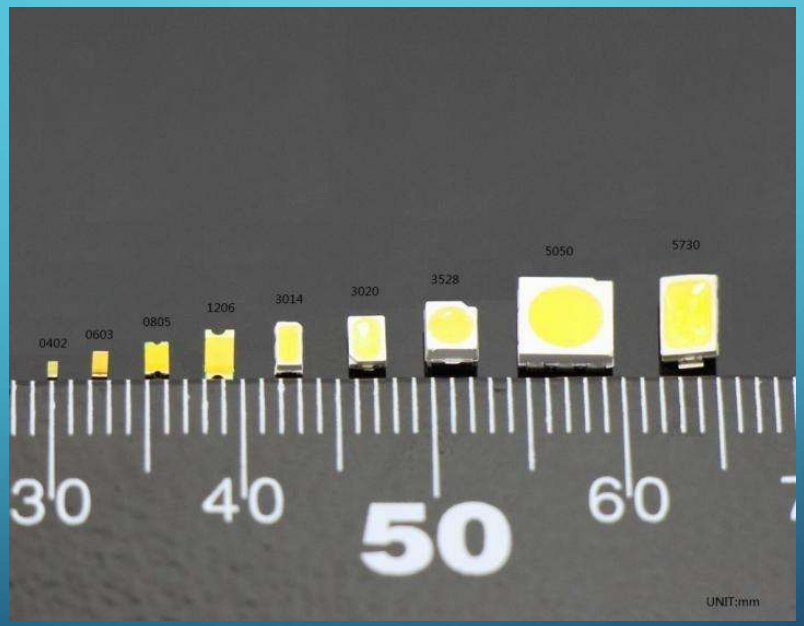
- T1 (3mm)
- T1 ¾ (5mm)
- Surface mount LED's are sized by rectangular dimensions. Common ones are:
  - 1206 .12" x .06" (3.2mm x 1.6mm)
  - 0805 .08" x .05" (2mm x 1.2mm)
  - 0603 .06" x .03" (1.6mm x .8mm)
  - 0402 .04" x .02" (1mm v .5mm)

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



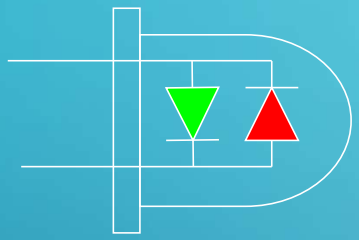
LED'S - CALCULATIONS

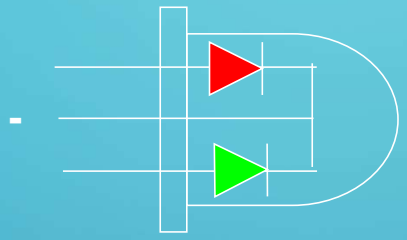
- V= Power Supply Voltage (transformer, decoder, etc.)
- V_F= LED Forward Voltage
- I = LED Forward Current
- R = Current Limiting Resistor
- $V - V_F = IR \rightarrow V - V_F / I = R$
- Example for White LED: 12-3=9/.010=900 Use 1KΩ min, 2KΩ usually works

BI-COLOR LED'S

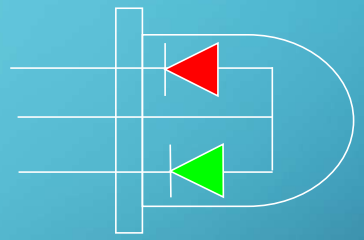
- Red / Green commonly used for Model RR use
- 2 lead: Red and Green chips are in reverse parallel (can be yellow on AC)
- 3 lead: Red and Green chips are either cathode to cathode (common -) or anode to anode (common +)
- Because Red is more efficient than Green, a balancing circuit is helpful

BI-COLOR LED'S CONTINUED

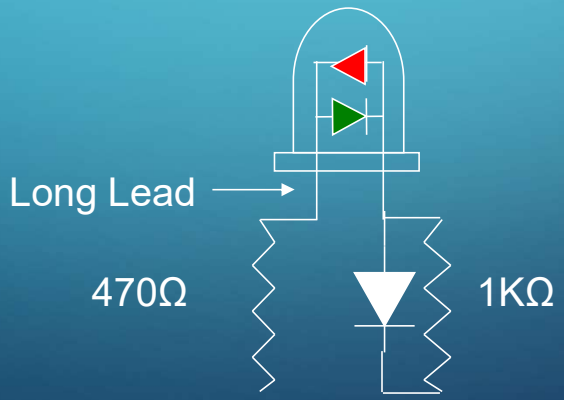




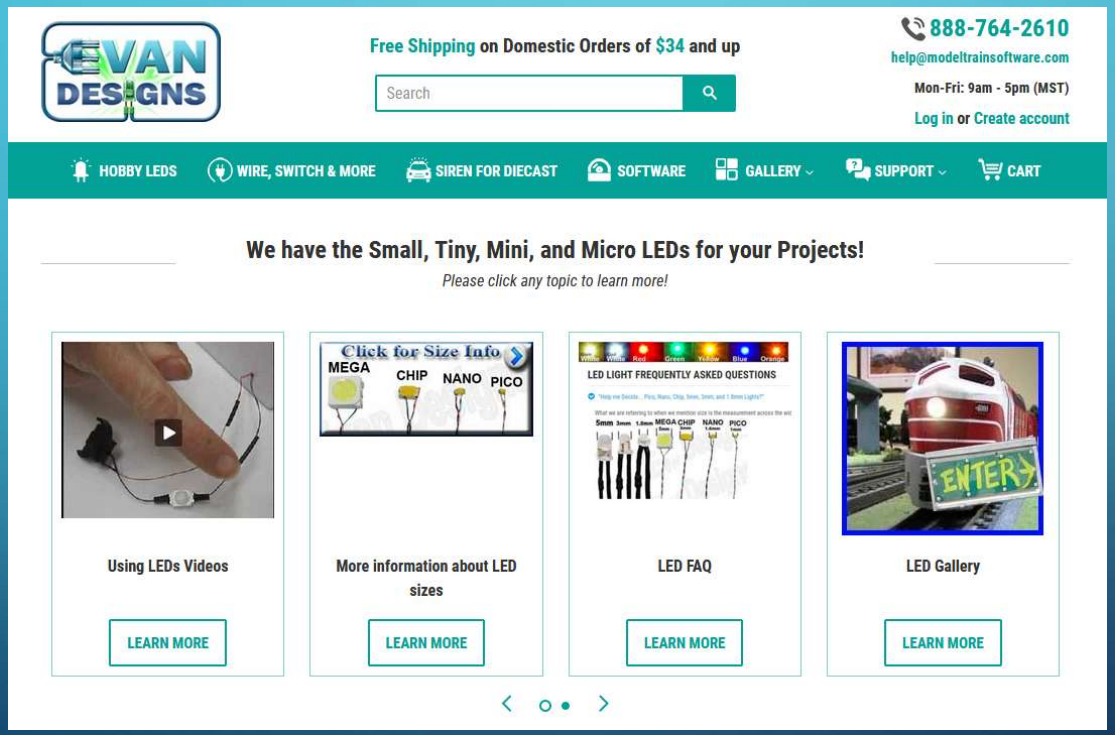
Cathode to Cathode



Anode to Anode



DO IT YOURSELF, OR:



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?