Driving LEDs

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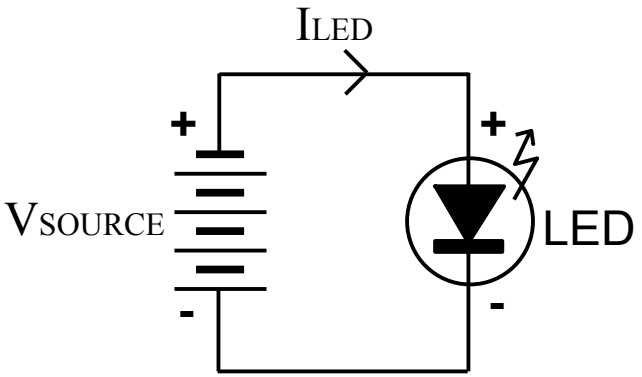
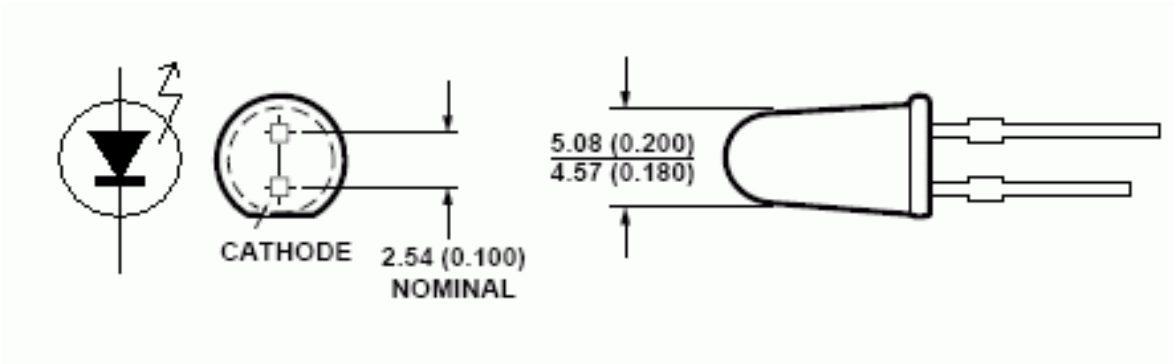
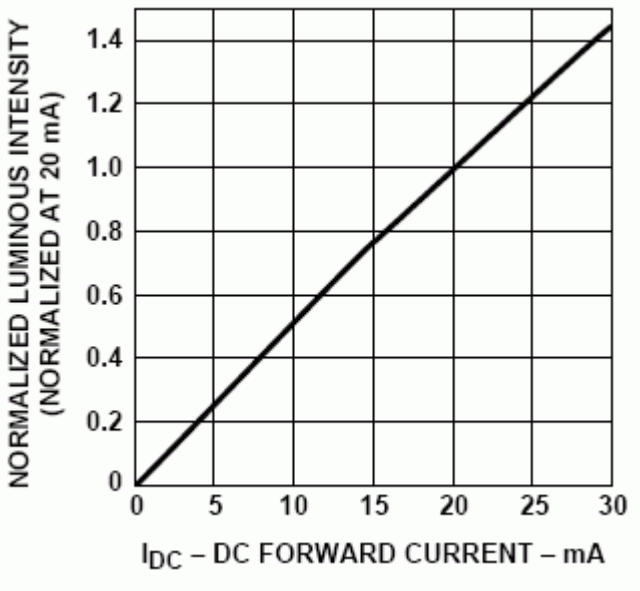
LED Hookup





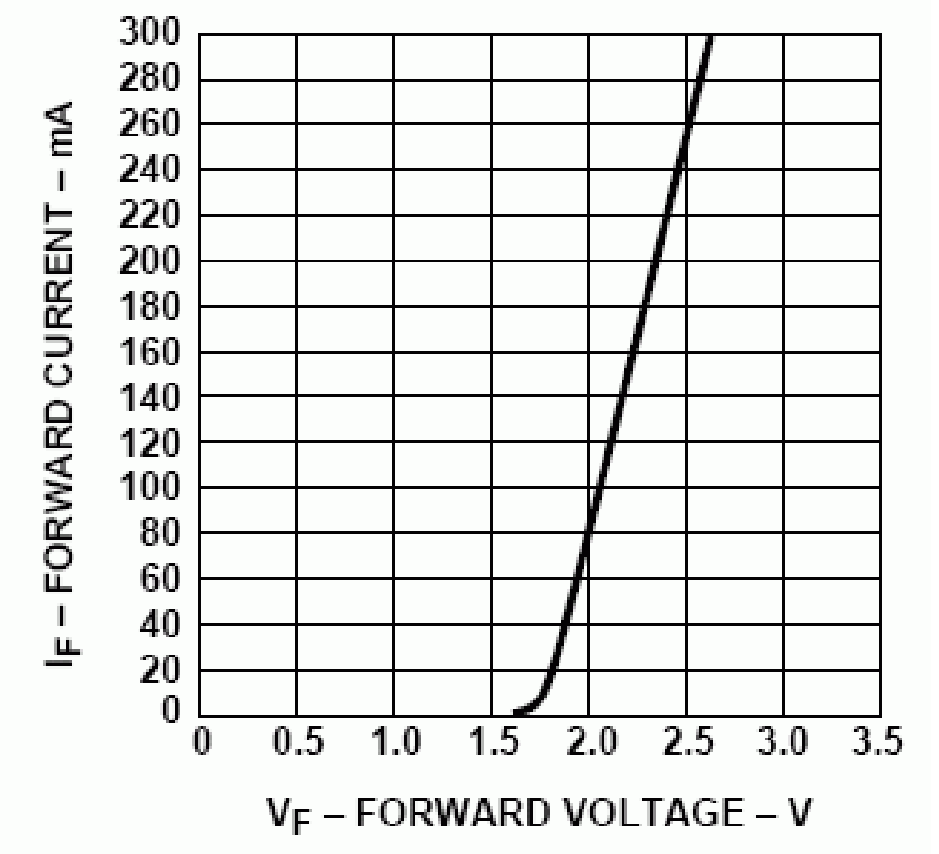
- Light Emitting Diode = LED
- Run current through LED to light:
  + to – or anode to cathode
- Flat side negative; long lead positive
- Brightness proportional to current --->
- Max 20 mA for typical 5mm LED
  (more current = shorter life)
- Rechargeable AA has 2400 mAHour so can run LED for 120 hours=5 days!



1 A = 1000 mA
A=Amp mA=Milliamp

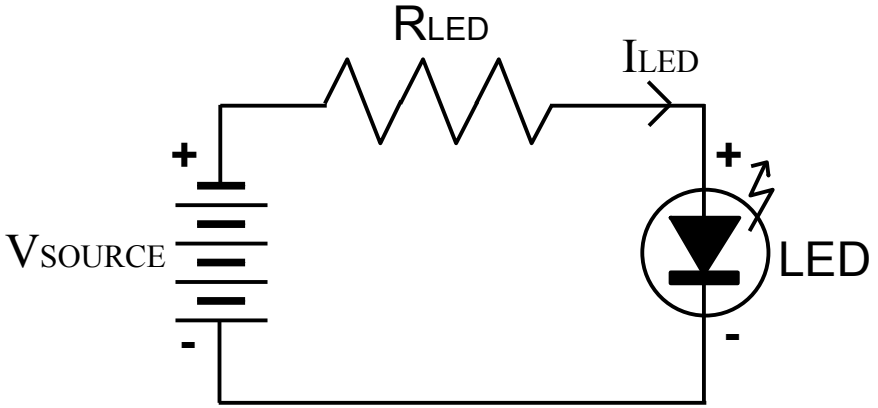
That sounds easy, but...

- No current flows when under threshold voltage
- Current changes fast with voltage once LED turns on
- Voltage needed is probably not the voltage you have, but too much voltage will blow out LED or reduce life
- Brightness sensitive to small changes and differences between parts

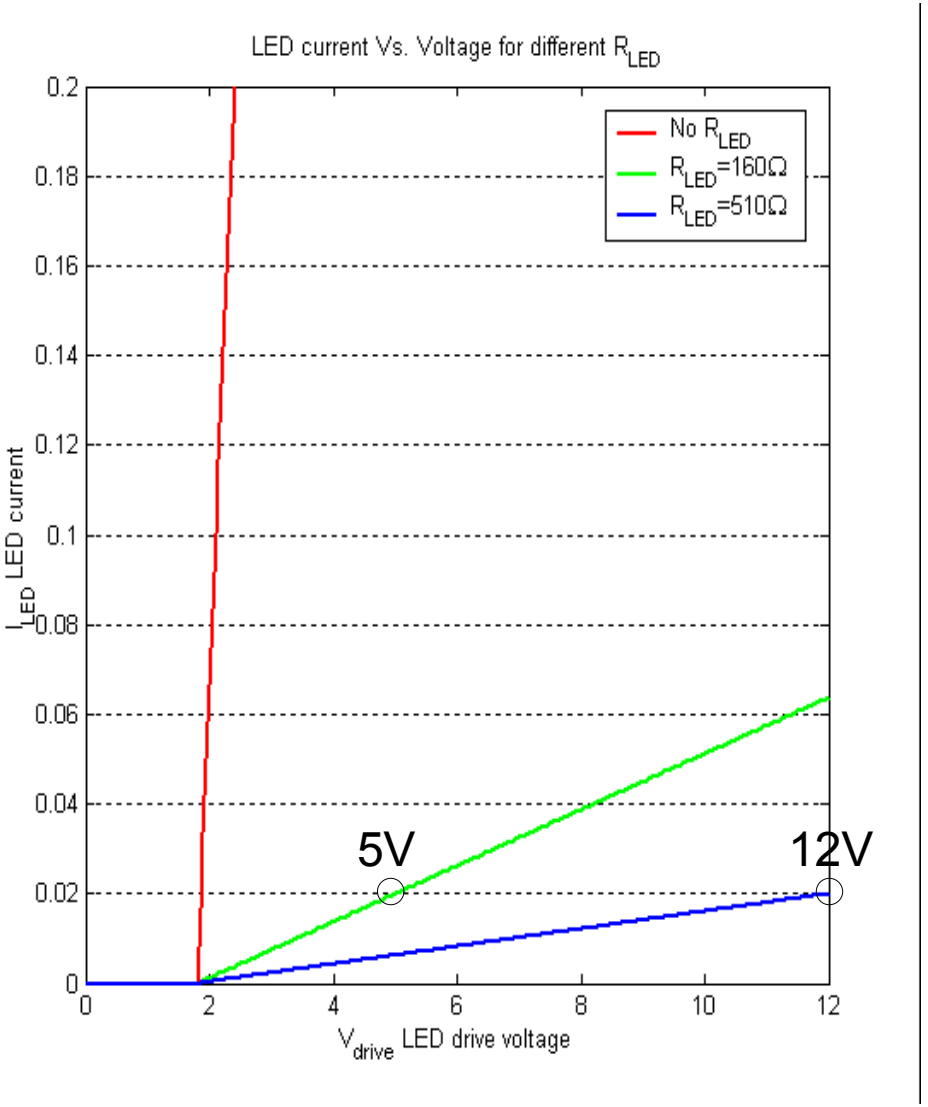


$V_F = V_{LED}$

Solution: Series Resistor

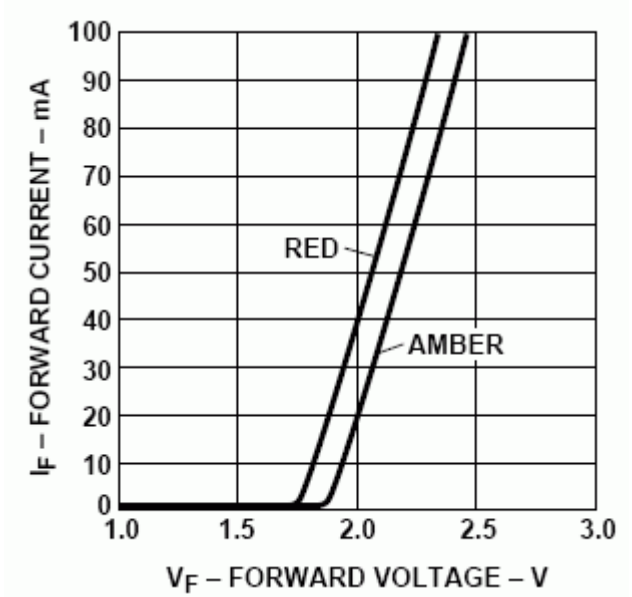


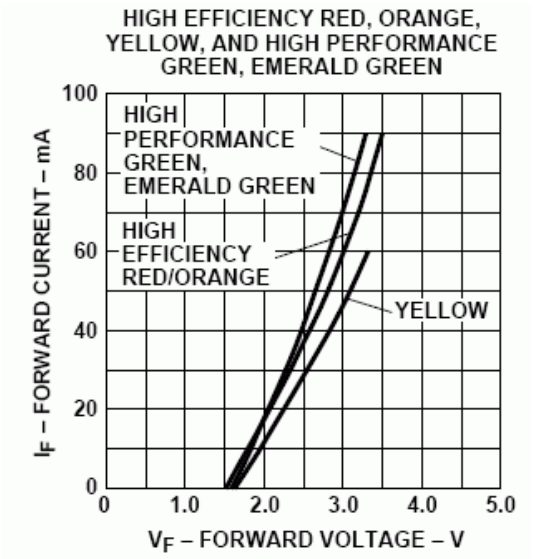
- Adding a resistor in series will decrease I vs V slope
- Enables higher drive voltages
- Reduces sensitivity to voltage and V_{thresh} variations
- Power dissipated in resistor is wasted – bad for batteries

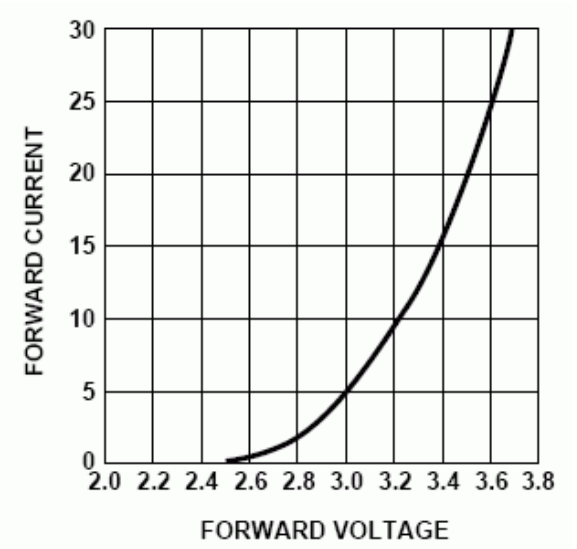


But which resistor?

- Formulas: V=I*R Units: [Volts]=[Amps]*[Ohms]
  and: $V_{SOURCE} = V_{RESISTOR} + V_{LED}$
- Find (or guess) V_{LED} for desired drive current (e.g. 0.02A)
- Calc: **$R_{LED} = (V_{SOURCE} - V_{LED}) / I_{LED}$**
- Check resistor power: $P_{RLED} = V*I = (I_{LED}*R_{LED}) * (I_{LED})$
- Common resistor powers: 1/8 W, 1/4 W, 1/2 W (W=Watts)







V_{LED} for: Red/Amber Orange/Yellow/Green Green/Blue/White

Examples

LED Color	I_LED (Amps)	V_LED (Volts)	R@5V (Ohms)	Power (Watts)	R@12V (Ohms)	Power (Watts)
Red	0.02	1.8	160	0.06	510	0.2
Amber	0.02	2	150	0.06	500	0.2
Yellow	0.02	2.2	140	0.06	490	0.2
Green	0.02	3.5	75	0.03	425	0.17
Blue	0.02	3.5	75	0.03	425	0.17
White	0.02	3.5	75	0.03	425	0.17
Luxeon	0.35	3.5	4	0.53	24	2.98