



# Making a DIY LED Fixture

Sam

# What we'll cover

- Pros and Cons of LEDs
- Basics of LED fixtures and fixture design
- Demonstrate a 27-LED fixture
- Soldering demonstration

# Why use LEDs?

- Physics:

- Low power consumption, high efficiency
- Can achieve very high light
- Long life
- Low heat input to tank

- Cosmetics

- Point source generates shimmer effect
- Dimming options and color tuning.

# Why isn't everyone using LEDs?

- Costs can be high
  - Individual high output LEDs ~\$5. High end DIY costs can easily exceed retail T5HO.
- No great retail options
  - High light products aim at reefers (blue light).
  - Low output fixtures are too dim for us.
- DIY approach still being refined
  - No “tried and true” approach yet
  - Not easy to see what you'll end up with

# Basics of LEDs

- Operate on DC power.
  - Low power LEDs use 0.10-0.50 A
  - Higher power LEDs use up to 1.5 A
- Usually used in strings of multiple LEDs, wired in series and powered by a driver.
- Require a heatsink to dissipate heat.

# But what is all this stuff?!?



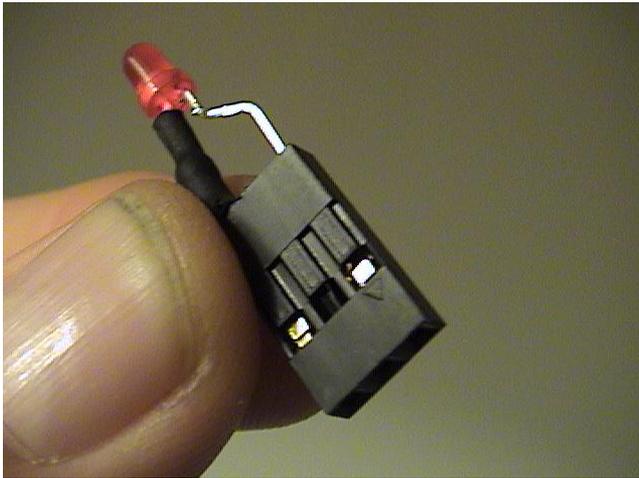
# Parts of a DIY LED array

- Required:
  - LEDs
  - Heatsink
  - Driver
  - Something to hold the thing in place.
- Optional:
  - Dimming circuit
  - Active cooling
  - Optics for LEDs
  - Something to make the thing look nice

# #1a: LEDs

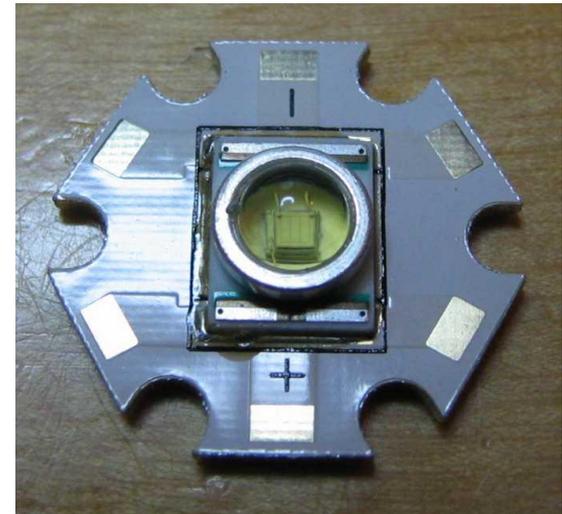
- Two basic approaches:
  - Lots of cheap low-power LEDs
  - Fewer expensive high-power LEDs
- Well known producers:
  - Cree, Luxeon, Bridgelux

# #1 b: LED Packaging



LEDs can be small  
and hard to work with

Solution: purchase  
pre-mounted “stars”



# #1c: LED Optics

Bare LEDs generate wide arc of light. Optics focus the light, allowing higher fixture positioning and better light penetration in deeper tanks.



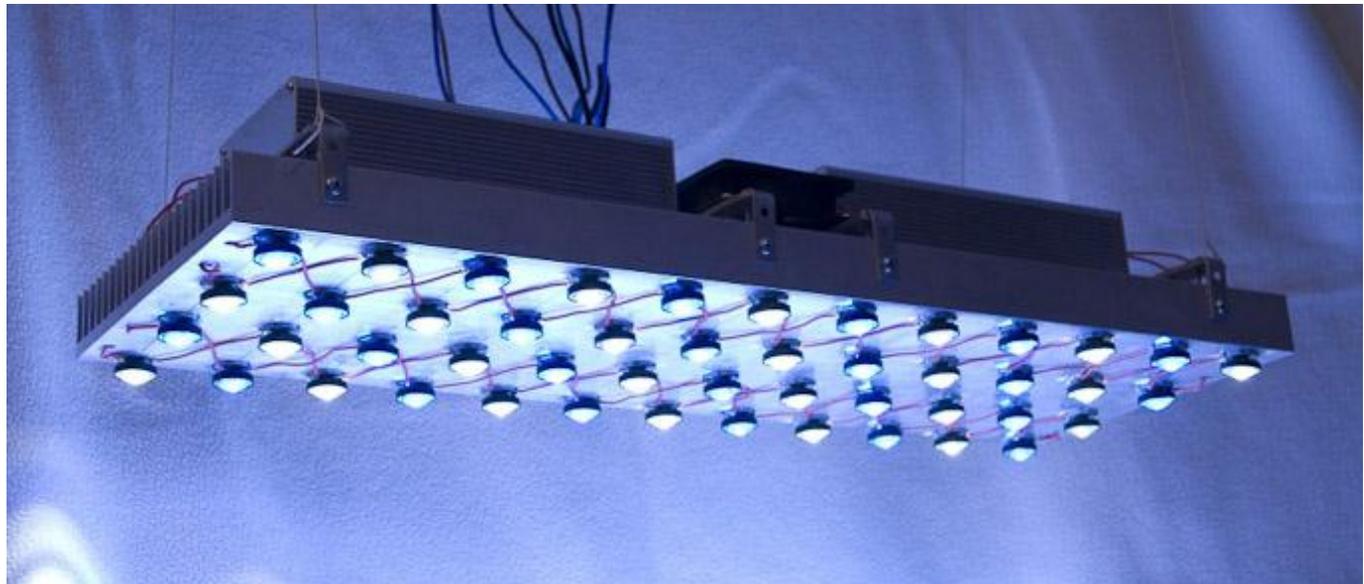
## #2a: Heat dissipation

- LEDs need to be kept cool.
  - Cheap/Simple approach: Aluminum channel or bar, preferably 1/4" thick.



## #2b: Heat Dissipation

- “Massive heatsink” approach:
  - Use extruded aluminum heatsinks
  - Many use HeatsinkUSA products



## #2c: Heat dissipation

- Mounting options: glue or screw.
- Adhesives are easy but more permanent.
  - Two-part thermal epoxies
  - Adhesive thermal tape

# #2d: Heat Dissipation

- Screws are better (use thermal paste).
  - Can buy pre-drilled and tapped heatsinks
  - Learn to drill and tap.

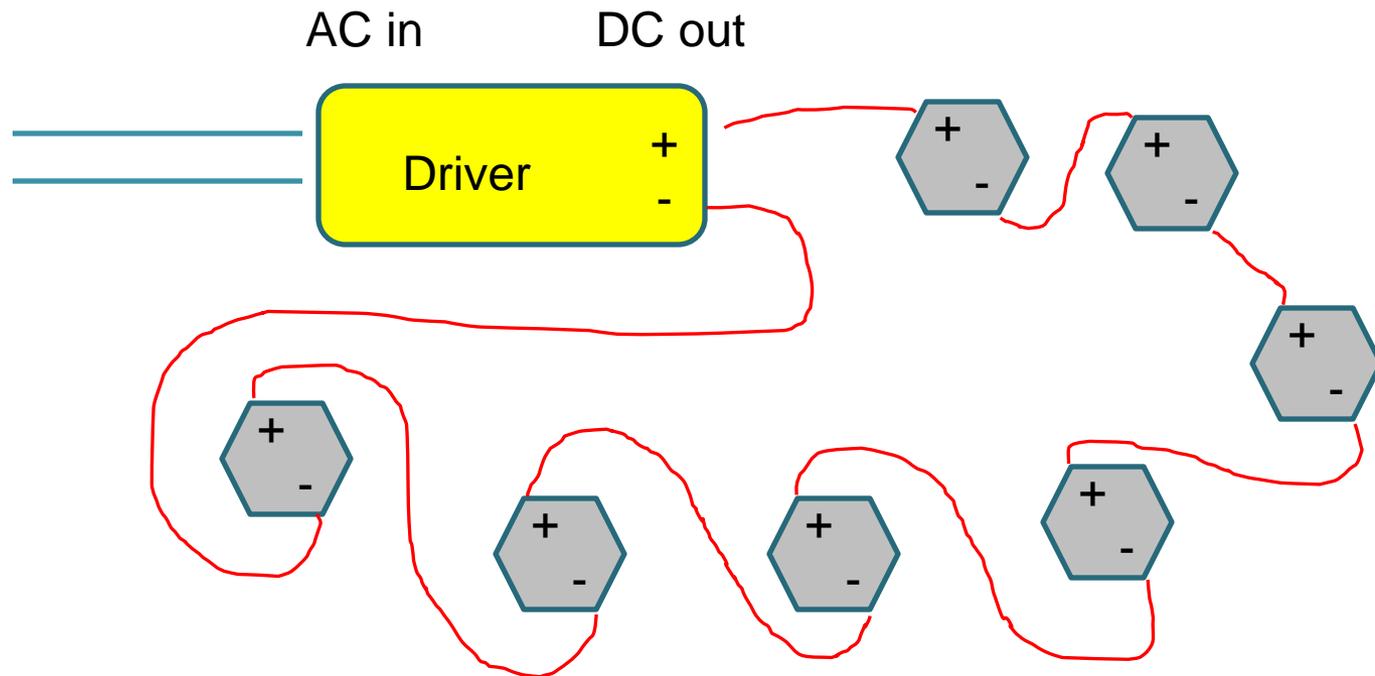


# #3: “Driving” the LEDs

- Driver provides constant DC current.
  - Most people purchase this pre-made.
- Number of LEDs per driver limited by driver capacity and type of LEDs used.
  - Meanwell driver can deliver 49v at 1.5mA, and Cree XP-Gs each need 3.3v forward voltage → 14 LEDs per driver.
  - Drivers also have minimum voltage requirements, so you can't have too few LEDs on a string either. (Don't test individual LEDs with your driver!)

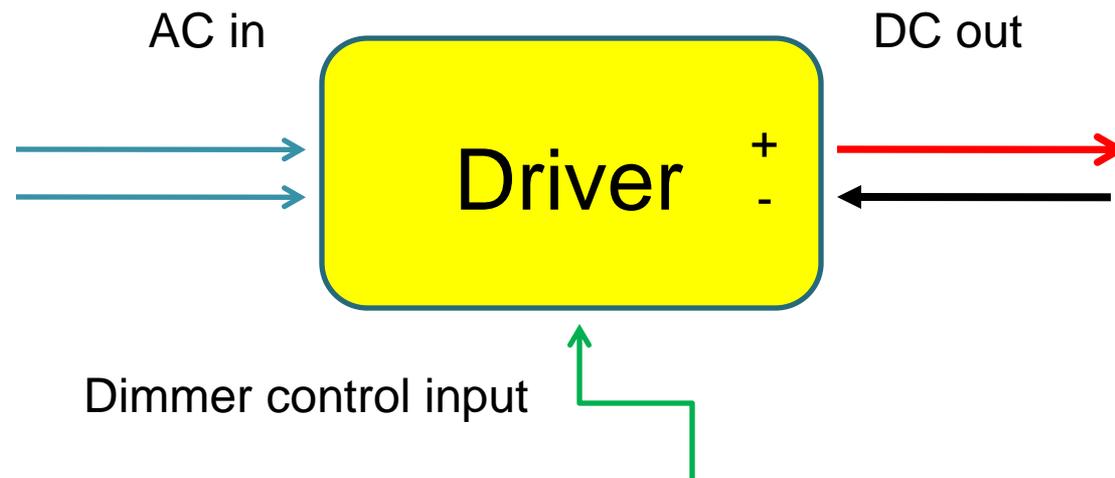
# #4a: The theory of wiring LEDs

- Simple: AC power goes into driver, DC power goes out to LEDs wired in series



# #4b: Dimming Circuits

- Dimmable drivers require another circuit
  - Can voltage (e.g. 0-10v) or pulse-width modulation (PWM) signal.
  - Use retail “aquarium controllers” or control voltage manually.



## #4c: The mechanics of wiring LEDs.

- Soldering is a useful life skill.
- Tips:
  - Practice first!
  - Use a large (40 watt or more) iron
- Cheat:



# “Finishing” the completed fixture

- Again, many options
  - Suspend from ceiling or supports
  - Integrate into hood
- Height, optics and LED density interact:
  - Large fixtures using widely spaced LEDs can be mounted close to tank.
  - Smaller fixtures with closely spaced LEDs can be treated like MH fixtures – hang high and project light into tank, focus with optics





# Remember!

- You can mix and match LED types and color—within limitations of your driver.
- You can swap LEDs after you're finished.
- Easy to dim, hard to brighten.
- Besides driver/LED compatibility, a lot of room for creativity.

# Costs

- *My costs were pretty high*
  - 27 LEDs – \$150
  - 27 lenses- \$30
  - Heatsink - \$100
  - 2 Drivers - \$75
  - Hardware (screws, washers) - \$20
  - Tools (soldering iron, taps, etc.)
- *But you can do this much more cheaply.*

# Observations

- This is all somewhat experimental.
  - Kits guarantee compatibility, support.
  - Adding moonlighting to existing hood can be easier project.
- Kit manufacturers are good information sources.
- No individual part is hard, but a fair number of steps.

# Resources

- Planted tank forums
  - RedfishSC
- Reef forums
  - Evilc66
- DIY LED kit suppliers
  - Nanotuners
  - Rapid-LED

# List of things to bring

- Fixture
- Taps
- Solder gun
- Extra stars
- Wire