



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?!?



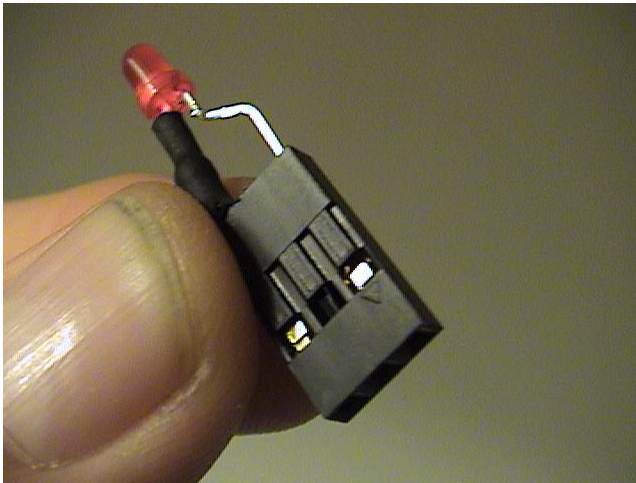
Parts of a DIY LED array

- 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

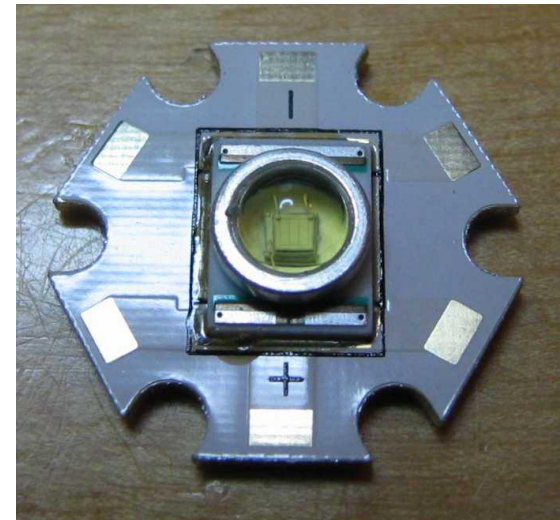
- Two basic approaches:
 - Lots of cheap low-power LEDs
 - Fewer expensive high-power LEDs
- Well known producers:
 - Cree, Luxeon, Bridgelux

#1 b: LED Packaging



LEDs can be small
and hard to work with

Solution: purchase
pre-mounted “stars”



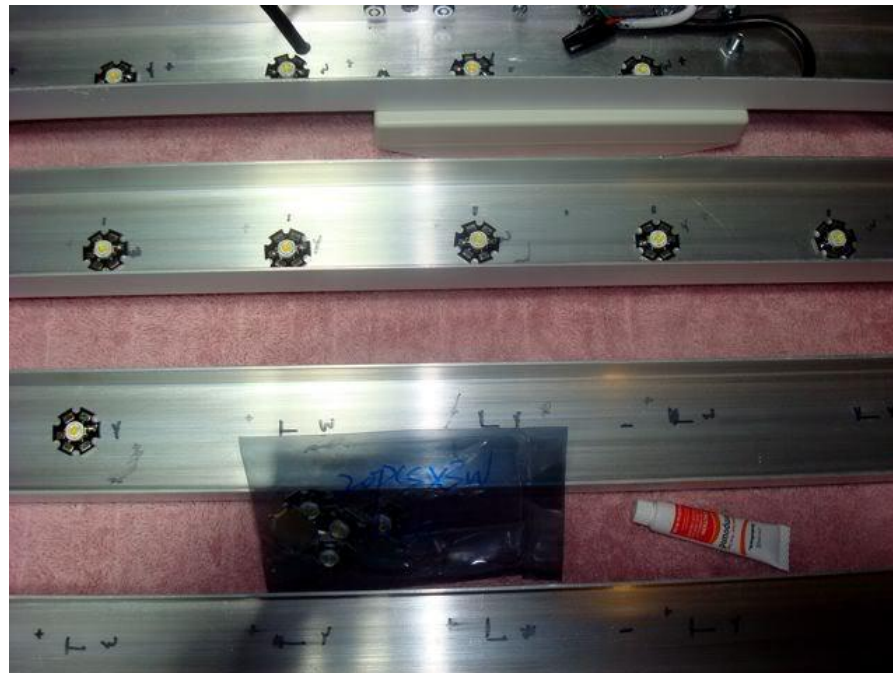
#1c: LED Optics

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



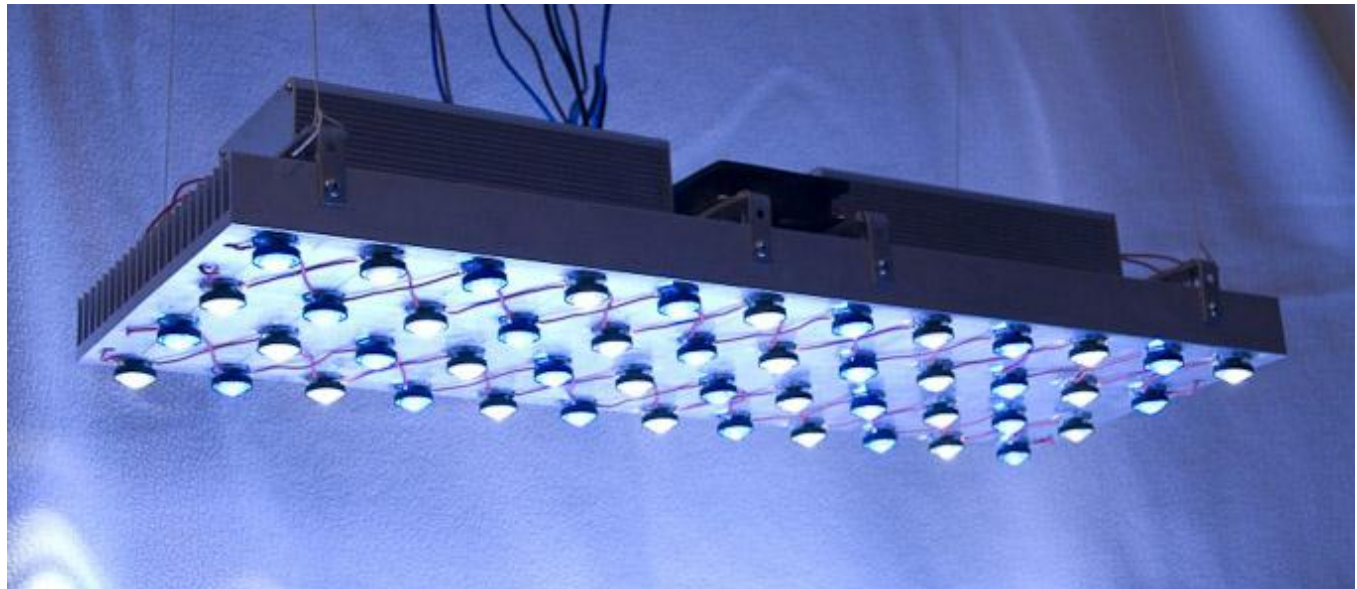
#2a: Heat dissipation

- 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.

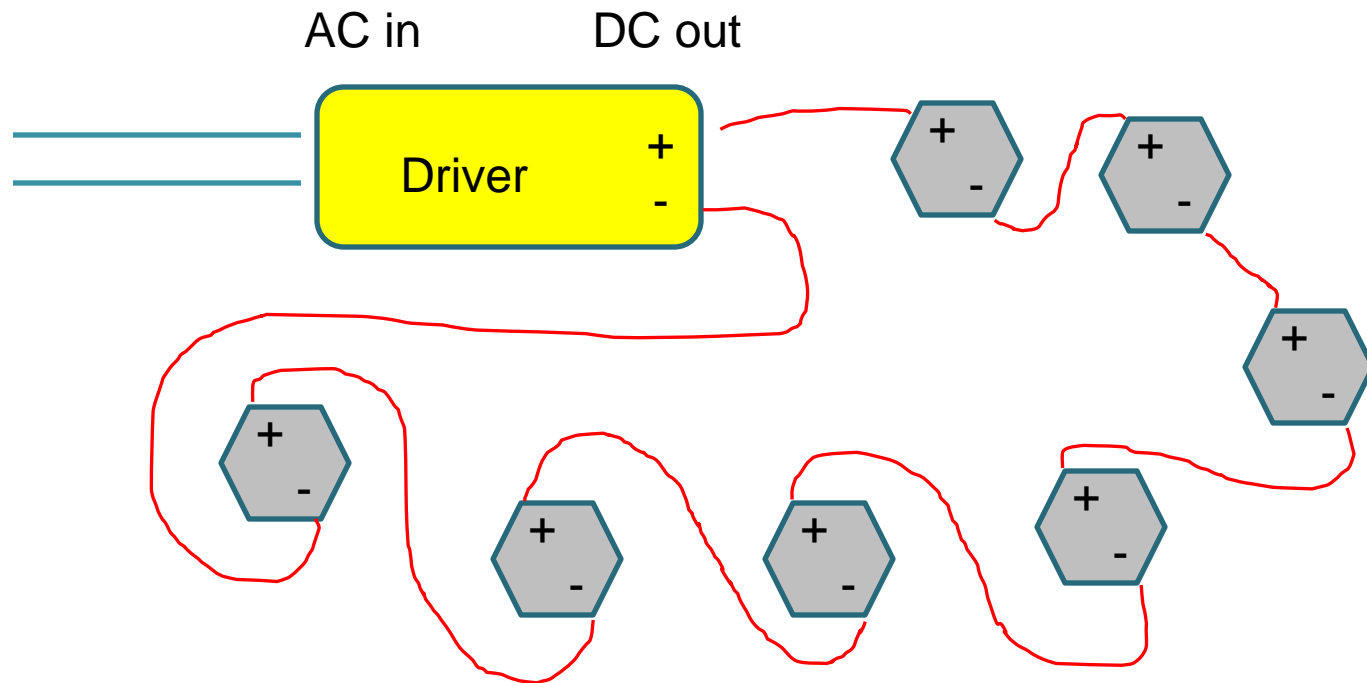


#3: “Driving” the LEDs

- 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!)

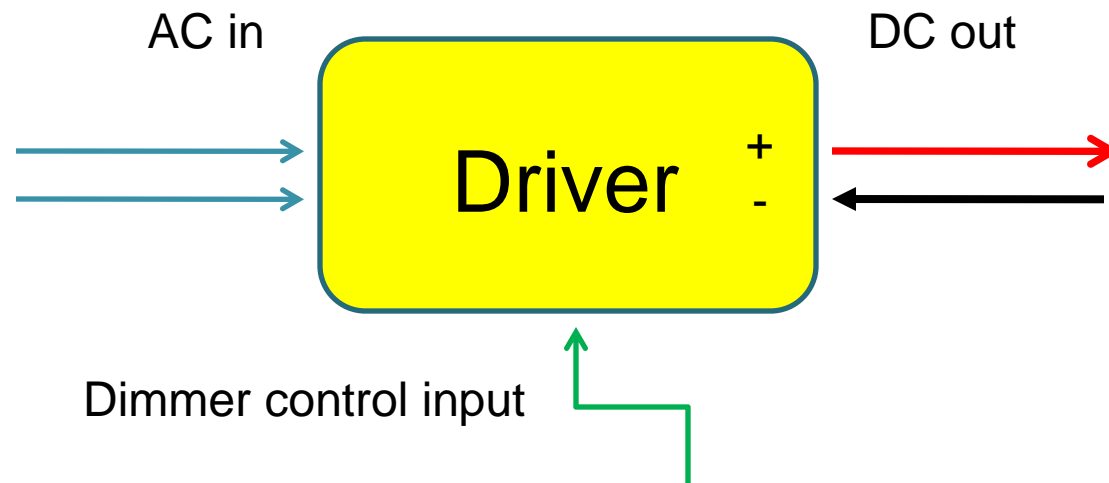
#4a: The theory of wiring LEDs

- 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