AC-DC DIY LED Flasher Module w/Adj. Speed-Notes R4.21 01-25-20

This board provides a compact, easy to assemble, inexpensive module to alternately flash 2 or more LED's, in a constant speed wig-wag fashion. It's easily capable of up to 100 ma load, can be powered by 5-12 volts AC or DC. It can operate up to 6 LED's connected to each output; eg six 2 headed signals, or two 4 headed signals plus two 2 headed signals. It uses the simple well known "multivibrator" flip-flop circuit. With the components shown and a 200K trim pot, the flash rate is adjustable from about 3 Hz to 0.7 Hz. The cycle speed is not affected by changing load or supply voltage.

The main application is trackside rail crossbuck signal heads, but it could also be used in an engine for flashing ditch lights, or in a building for flashing marquee lights, or anything similar. The LEDs can be wired and connected separately, or in a common anode fashion. This makes them ideal for use with crossing signals offered by WeHonest, or JTD for example. Control is simply by on-off power switching using a 153IR, relay, or other similar means. Once powered the module starts flashing immediately.

The board is a very compact size; 1.375" x 1.0" There are only ten components, and easy thru-hole assembly. Board material can be 1.6 or 0.8 mm thick with 1 oz copper. Load carrying traces are a full 20 mils width. Three 2-pin 0.1" pitch headers accommodate input and output connections.

D1 is a standard 1 amp DB107G bridge DIP diode to rectify AC to DC. DC can be connected directly and polarity is unimportant. C1 can be a 220 uF or larger 25 vdc electrolytic, but 220 uF is adequate.
If the input is DC, you don't need D1 or C1 at all, simply jumper across the D1 inputs to outputs, but in this case be sure to observe supply polarity.

Q1 & Q2 are S8050 NPN Darlington transistors rated at 700 ma and 2 watts TDH. No heat sinking is needed. TDH is found by Vdc x I. So for 12 volts @ 90 ma load, TDH = 1.08 watts. This represents up to 6 leds @ 15 ma each per output; 12 total. R5 is a Bourns 3362P style trim pot, Digikey 3362P-204LF-ND

R1/R2 are nominal 200 ohm LED ballast resistors, sized for one LED per output and 6 volt DC input, with no D1 bridge. For higher supply voltages you can change them to higher values such as 560 ohm for a 12 Vdc supply. Or you can add resistance in the LED wiring off-board at the rate of 60 ohms per volt DC over 6 volts. For example, using a 12 VDC supply add 360 ohms for a total of 560 ohms [R=200+60x(12-6)].
Note that for an AC supply the rectified DC voltage will be approximately Vdc=(Vacx1.41)-1.4 =15.5 volts. For this input R1/R2 should be at least 860 ohms each, or add about 680 ohms off-board. Use the reference Excel sheet for target values for R1/R2 for various supply voltages and numbers of LEDs.

Jumper block J4 provides for optional external switching to bypass Q1/Q2 and light the LED's continuously if desired. You can install most any 3 pin .1" pitch header (such as Dupont or SPOX) and wire it to a remote DPDT switch. If this feature is not needed simply leave the J4 pads bare.

You have a great number of options for making connections to the board. It accepts most styles of 0.1" pitch (2.54 mm) 2 pin input and output headers (eg. Dupont or SPOX), or common 0.1" pitch KF128 mini green screw terminal blocks, plus many others.
It can also be hard-wired directly using up to 22 AWG solid or stranded wire.
It can also be used with pre-wired Mini JST 1.25 male/female 2-pin or similar connector pigtails.

Using all domestic components and OSH Park boards, the total cost is about $5.75 each.
Using all offshore components and boards, the total cost is about $1.20 each.
These costs compare very favorably with the $12-$15 price of comparable modules found online.