

LED Non-Flicker Lighting Circuit for Passenger Cars

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Circuit design by Victor Hand

Requirements

- Powered from DCC track power, not batteries.
- Absolutely no flicker, even over sections of dirty track or gaps.
- Ability to position lights (LED's) in different locations depending on the floor plan of the individual car.
- Ability to simulate both incandescent and fluorescent lighting for both heavyweight and lightweight cars.
- Ability to turn lights on and off without a mechanical switch.
- “Economical” vs. commercially available circuits.

How it works

- DCC 14.25 VAC track power converted to 14.25 VDC by bridge rectifier.
- Two magnetic reed switches control double pole double throw (DPDT) latching relay.
 - Reed switches are located under roof at each end of the car.
 - Magnet activates one reed switch and latches relay turning on the circuit and other reed switch will reset relay when activated to turn the circuit off.
- DPDT Relay when latched charges super capacitors and turns LED's on.
 - When relay is reset, LED's are turned off and super capacitors are disconnected.
 - Relay can only be activated when track power is on.
- Super capacitors (3 - 5.5V .33F) are wired in series and can handle 16.5 volts.
 - Capacitors charge and deliver from 10 to 16 volts when track power is interrupted.
 - An average circuit with nine LED's will stay lighted for several minutes with no track power once charged.
- Voltage regulator reduces voltage from capacitors to 3.3 volts to power LED's.
- Trim potentiometer allows adjustment of LED brightness.
 - LED's should run at slightly less than full brightness to eliminate any slight flickering and to extend life.

Components – Mouser Part Numbers

• Twin Industries prototype board 10x10 in. – Enough for nine circuits = \$6.38 per circuit	589-8000-1010-LF	\$63.75
• Vishay bridge rectifier 1A 100V	625-DF01M-E3	\$.36
• Coto Tech magnetic reed switch * – Two per circuit	816-RI-25AAA	\$ 1.20 ea.
• TE Connectivity dual latching relay	655-D3066	\$ 2.86
• Elna Supercapacitors 5.5V 0.33F – Three per circuit	555-DX-5R5H334U	\$ 1.60 ea.
• ST voltage regulator 3.3V .05A	511-LF33ABV	\$.85
• Bourns trimmer resistor 5K ohms 10%	652-3362W-1-502LF	\$.93
• Osram warm white LED 3200K – Nine per circuit for 85' HW cars to simulate incandescent lighting	720-LCWE6SGV1AB4U9	\$.59 ea.
• Seoul cool white LED – Nine per circuit for 85' LW cars to simulate fluorescent lighting	889-AWT801-S	\$.55 ea.

Approximate cost per circuit +/- \$25

NOTE: Pricing is for quantities of 10+ as of 05 May 2013

* Obsolete item at Mouser, but 500+ in stock

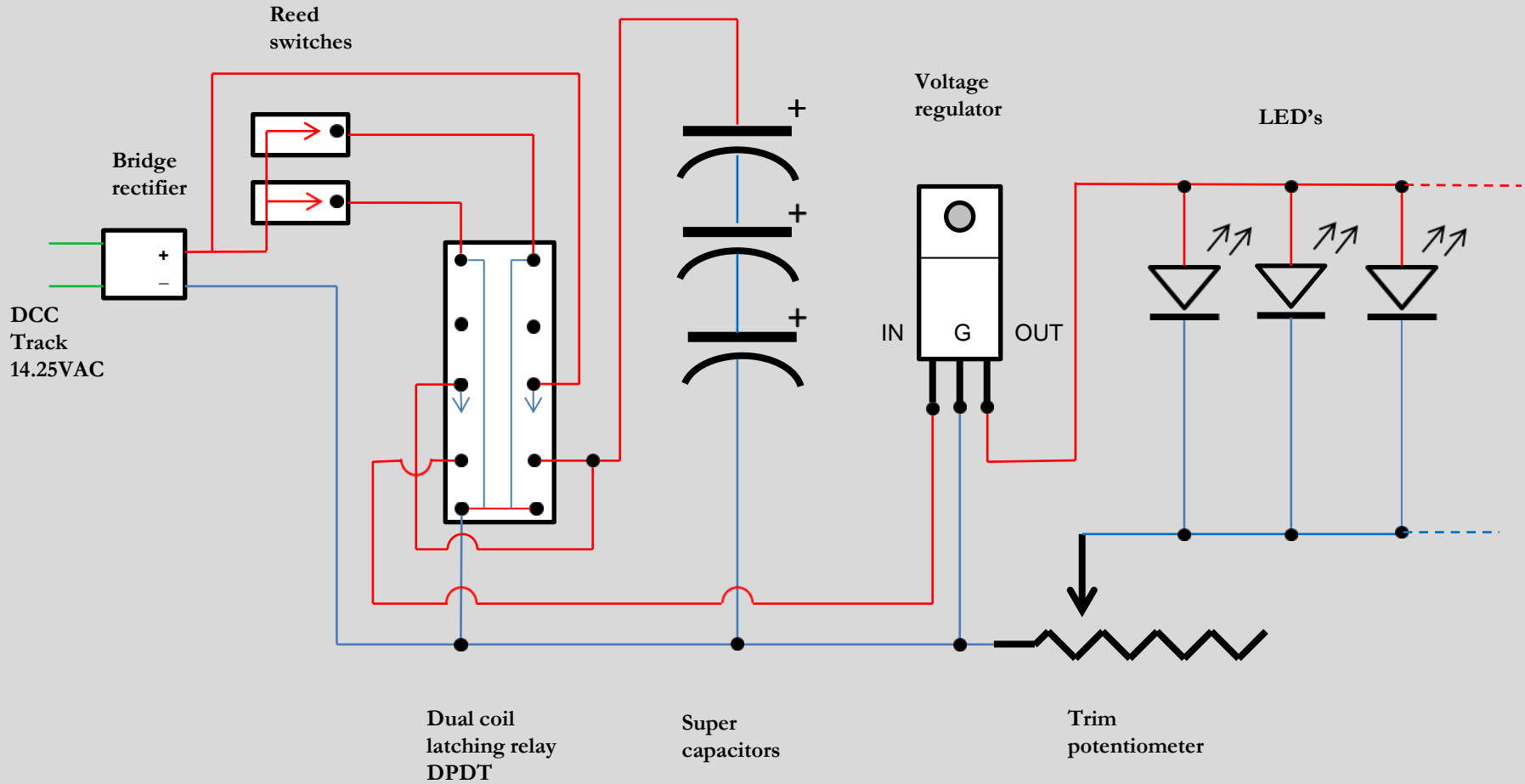
Other Supplies

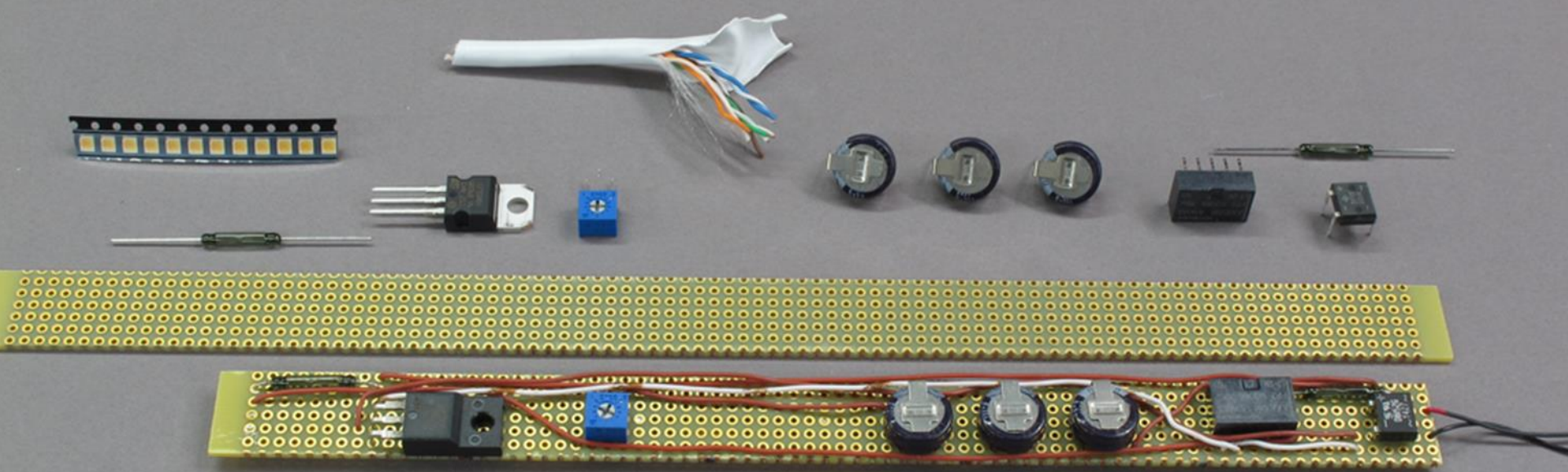
Engineering/Mouser/Home Depot

• Miniature 12 watt soldering iron	N40M2	\$29.75
• Needle tip – iron clad & nickel plated	N4081	\$ 7.35
• Low temperature silver bearing solder	N4200	\$ 5.95
• Wire wrap hook-up 30AWG wire – white 50'	801-R-30W-0050	\$ 9.65
• Wire wrap hook-up 30AWG wire – blue 50'	801-R-30B-0050	\$ 9.65
• 32 AWG super flexible wire - 5 feet	N5032	\$ 4.00
• CAT-5 Telephone cable	Home Depot	\$.10/ft

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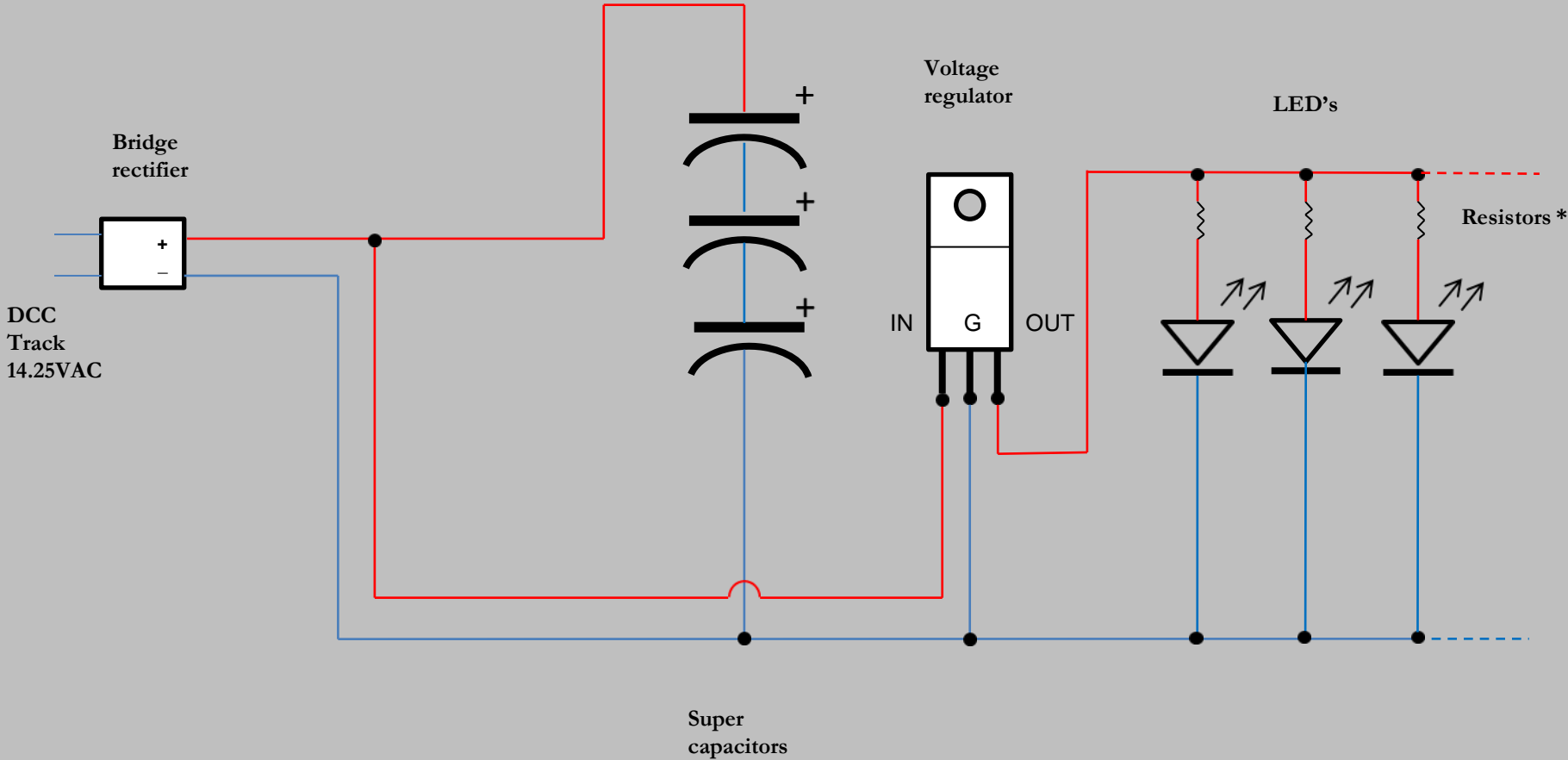








Simplified LED Non-Flicker Lighting Circuit (No On/Off Switch – No Potentiometer)



NOTE: Resistors required for each LED. Value determined by testing.