

# Circuit Simulation Project

<https://esim.fossee.in/circuit-simulation-project>

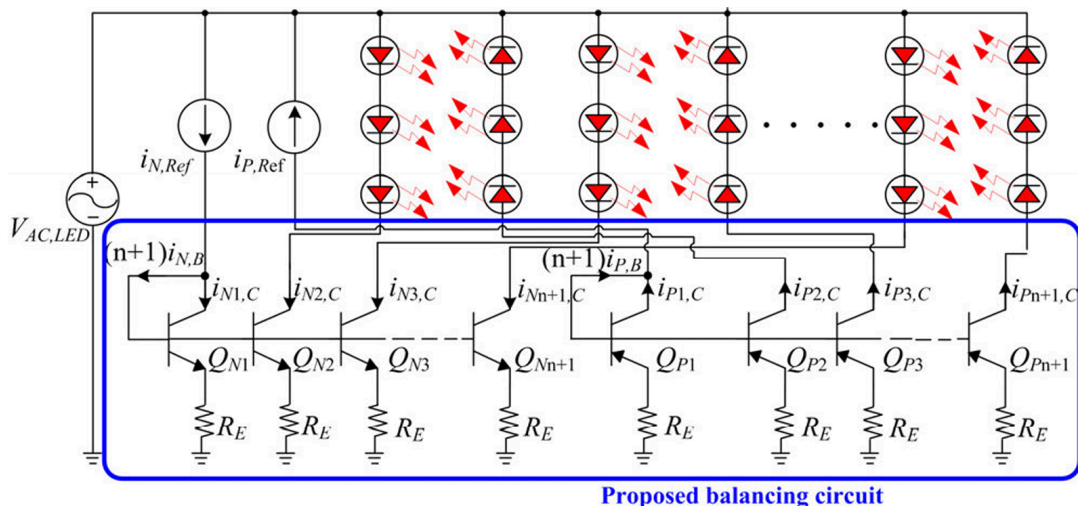
**Name of the participant :** K.S.Madhavkrishnan

**Title of the circuit :** Current Mirror Balancing Circuit for AC LED Lighting

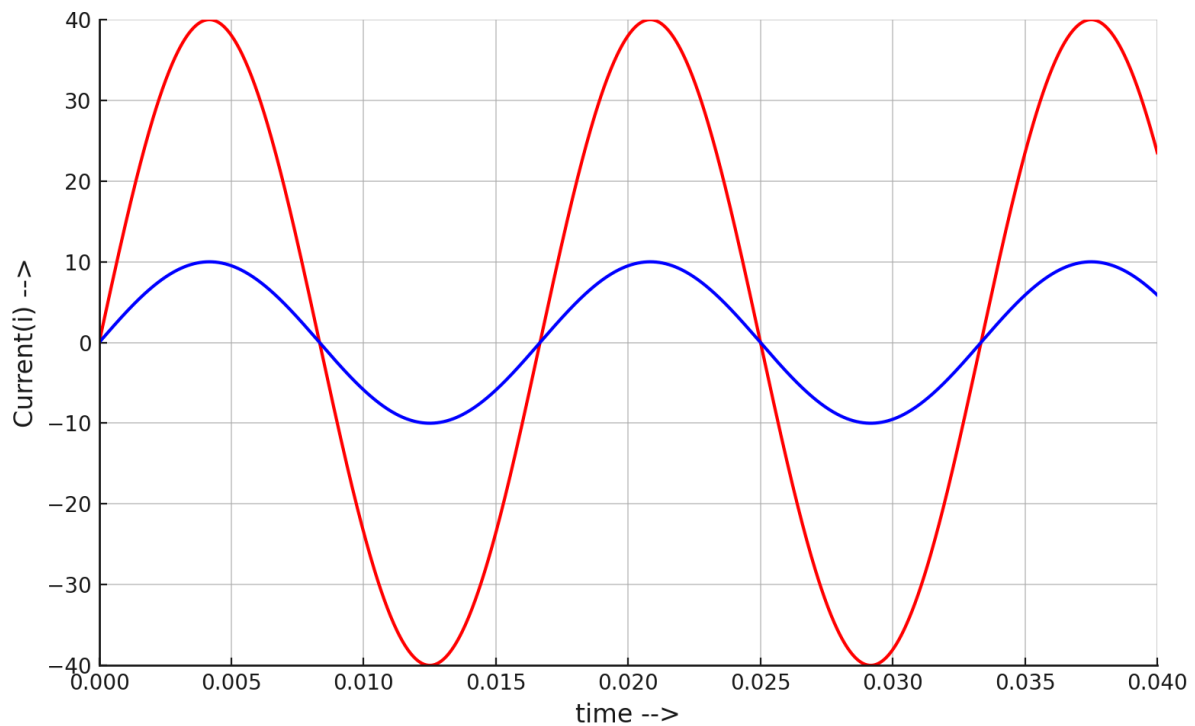
**Theory/Description :** The current mirror balancing circuit is designed to ensure uniform current distribution across multiple parallel LED strings in AC-driven lighting systems. In conventional LED arrays, mismatches in forward voltage or component tolerances can cause unequal current sharing, leading to over-driving of some LEDs and under-utilization of others, ultimately reducing efficiency and lifespan. To overcome this, the proposed circuit employs current mirror configurations using bipolar junction transistors (BJTs) that replicate and balance the reference current across all LED branches.

When an AC supply is applied, the LED strings conduct alternately depending on the instantaneous polarity, while the current mirrors actively maintain equalized current flow in each path. This results in consistent brightness across all LEDs, improved reliability, and reduced thermal stress. Compared to simple resistor-based balancing methods, the current mirror approach provides more accurate current control with minimal power loss. The technique is especially suitable for solid-state lighting applications, where long-term stability and energy efficiency are critical.

**Circuit Diagram(s) :**



### Results (Input, Output waveforms and/or Multimeter readings) :



### Source/Reference(s) :

1. [Sedra, A. S., & Smith, K. C. \(2015\). \*Microelectronic Circuits\* \(7th ed.\). Oxford University Press.](#)
2. [Horowitz, P., & Hill, W. \(2015\). \*The Art of Electronics\* \(3rd ed.\). Cambridge University Press.](#)
3. [Franco, S. \(2014\). \*Design with Operational Amplifiers and Analog Integrated Circuits\* \(4th ed.\). McGraw-Hill.](#)
4. [Banerjee, D. \(2011\). \*LED Driver Design Guide\*. Texas Instruments.](#)
5. [Bian, Z., Hou, H., & Hu, X. \(2014\). "Current Balancing Techniques for Multistring LED Drivers." \*IEEE Transactions on Power Electronics\*, 29\(6\), 2954–2966.](#)
6. [Choi, H. H., & Cho, G. H. \(2012\). "AC-LED Driver with Improved Power Factor and Current Balancing." \*IEEE Transactions on Industrial Electronics\*, 59\(4\), 1698–1707.](#)