Research Migration Project

https://esim.fossee.in/research-migration-project

The Research Migration Project is an initiative of FOSSEE, IIT Bombay that promotes the use of eSim for reproducing published research circuits originally implemented using proprietary simulation tools. The objective is to migrate these validated designs to eSim to build an open source resource database.

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Title of the circuit : *AC/DC CONVERTER USING 0.18um CMOS*

Theory/Description :

This project focuses on a CMOS based full-wave AC/DC converter designed for low power devices. Traditional rectifiers use standard diodes that waste significant power due to a high (0.7 V turn on/knee voltage/forward voltage drop) voltage. To fix this, the circuit replaces diodes with four power-MOSFETs arranged in a bridge configuration. These MOSFETs act as ideal switches with very low resistance to reduce energy loss.

The bridge uses two pMOS and two nMOS transistors with a specific width of 50um and length of 0.18um or 180nm. When the input signal is positive, one pair of transistors conducts. when negative, the other pair takes over. This ensures that the current always flows in the same direction toward the load.

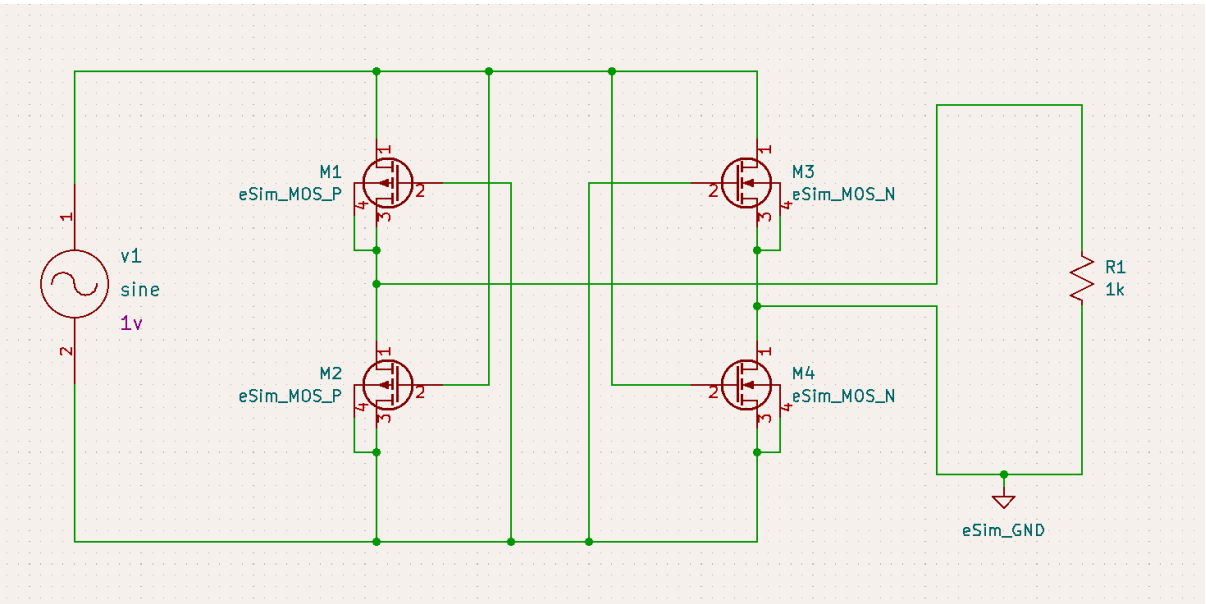
Reason to reproduce with eSim : Reproducing this AC-DC converter circuit in eSim offers several technical and practical advantages for students and researchers looking to validate the findings.

Expected Outcome/outputs : *

- **The simulation will output a fully rectified DC signal from 1v AC.**
- **The circuit will show a very low voltage drop.**

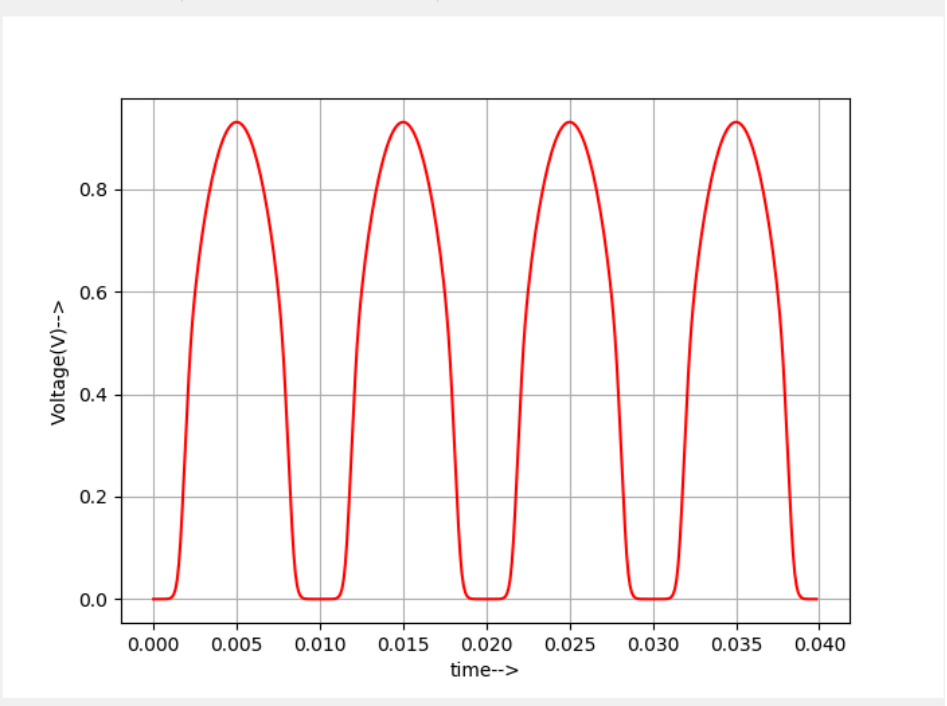
- **A measured power efficiency is expected which shows the minimisation of energy loss.**
- **Due to the 180 nm/0.18 um channel length, the output will show pointy transitions at 50 Hz frequency.**
- **The system will provide a proper output voltage almost equivalent to input / output.**

Circuit Diagram(s) :



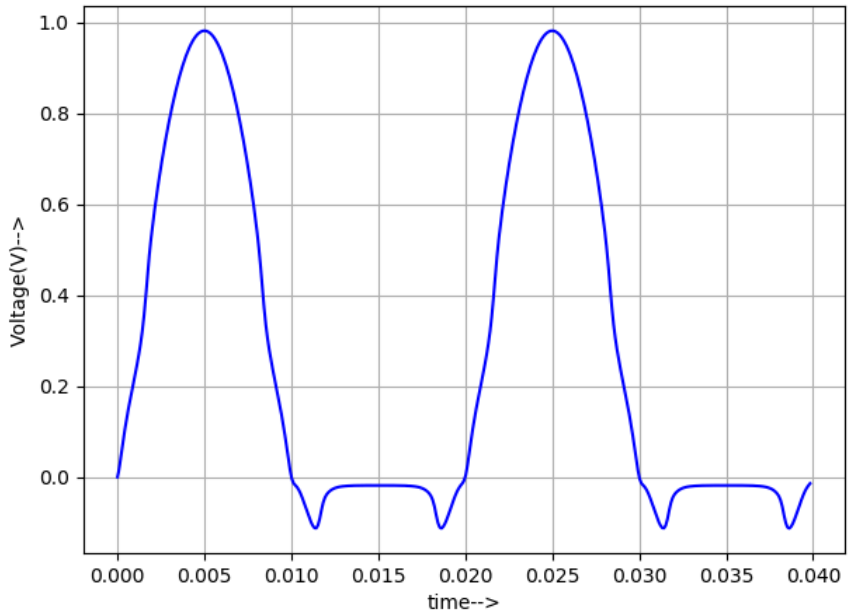
Expected Results (Input, Output waveforms and/or Multimeter readings) :

This graph shows the voltage measured across the resistive load after the rectification process, with very low voltage drop.

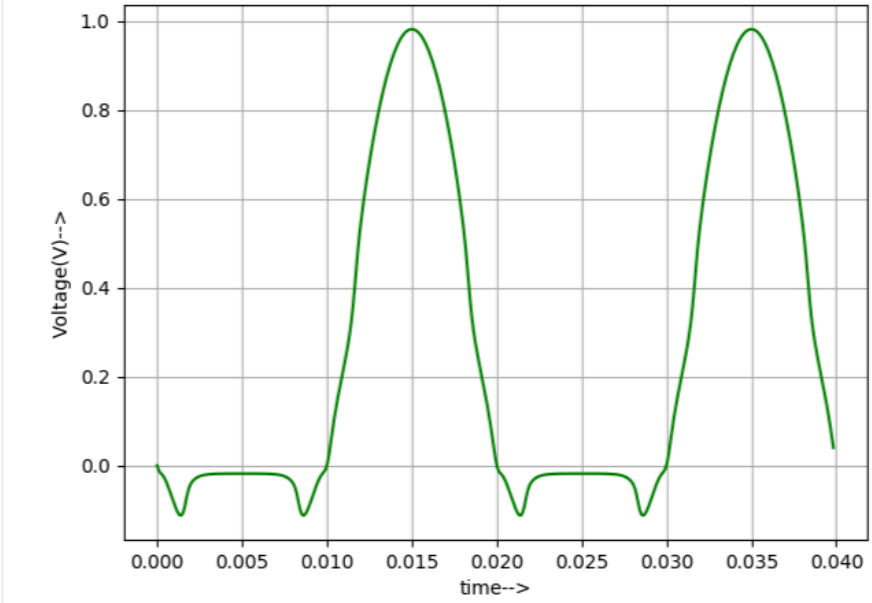


This graph represents the current flowing out of the rectifier to the load.

as mosfet conducts the waveform starts 0v at t = 0.



This graph tracks the current being drawn from the AC source. This shows current moving in both directions (positive and negative peaks) because it is measured at the AC input side



Research Paper/Journal/etc.: *

Title : Modeling of AC-DC converter using 0.18 µm CMOS Technology

Author : Roskhatijah Radzuan, Mohd Azril Ab Raop, Mohd Khairul Mohd Salleh, Mustafar Kamal Hamzah

Page No. : all pages are related to cmos convertor ac/dc

Link :

https://www.researchgate.net/profile/Mohd-Khairul-Mohd-Salleh/publication/258263199_Modeling_of_AC-DC_converter_using_018_mum_CMOS_technology/links/54ed70000cf27fbfd7724ef0/Modeling-of-AC-DC-converter-using-018-mum-CMOS-technology.pdf

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