

**Lecture # 12**

# ECEN 438/738 Power Electronics

Spring 2025 Semester



**Dr. Prasad Enjeti,**  
Electrical & Computer Engineering  
Texas A&M University  
<http://enjeti.tamu.edu>

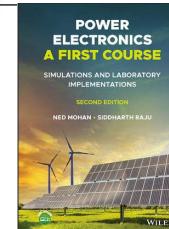
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## ECEN 438/738 Power Electronics

### Power Electronics A First Course: 2<sup>nd</sup> Edition

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**Chapter 5**  
**RECTIFICATION OF UTILITY INPUT USING DIODE RECTIFIERS**

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Written by Ned Mohan, Siddharth Balu

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January 2023  
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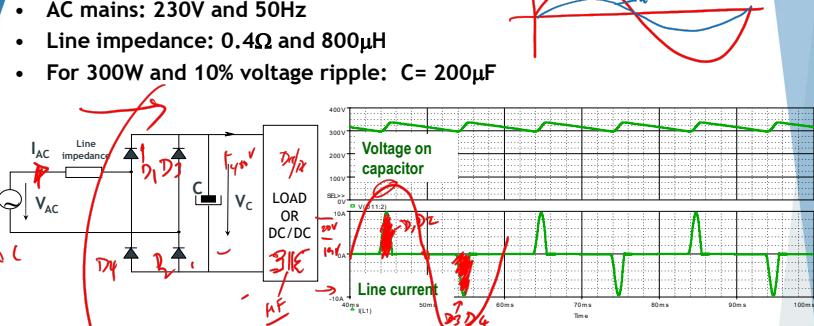
POWER ELECTRONICS A FIRST COURSE  
Enables students to understand power electronics systems, as one course, in an integrated electric energy systems curriculum

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### Single Phase Diode Rectifier --- and - Neutral Current

- AC mains: 230V and 50Hz
- Line impedance:  $0.4\Omega$  and  $800\mu\text{H}$
- For 300W and 10% voltage ripple:  $C = 200\mu\text{F}$

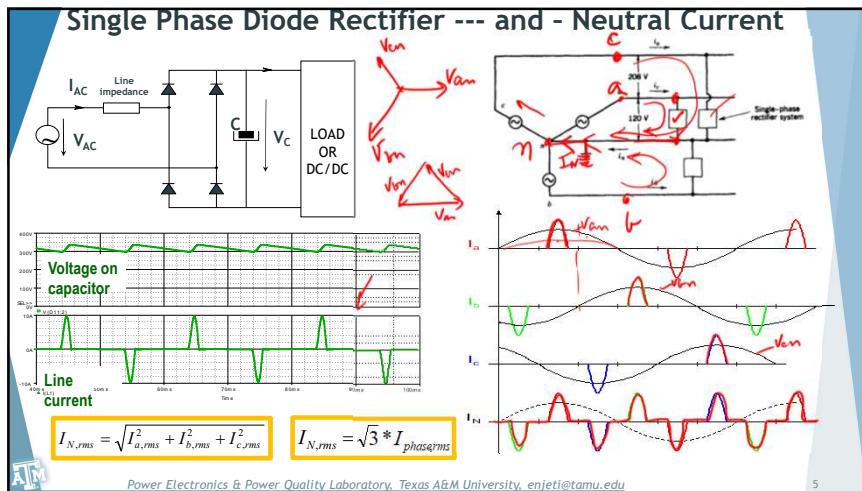


The diagram shows a single-phase AC source  $V_{AC}$  connected to a diode bridge rectifier. The output is connected to a load  $3k\Omega$  and a capacitor  $C$ . The circuit is labeled with  $I_{AC}$  for line current,  $D_1$  through  $D_4$  for the diodes, and  $V_C$  for the capacitor voltage. The top graph shows the AC voltage waveform with a 10% ripple. The bottom graph shows the line current waveform, which is zero during the negative half-cycle and flows only during the positive half-cycle when the voltage is greater than the capacitor voltage.

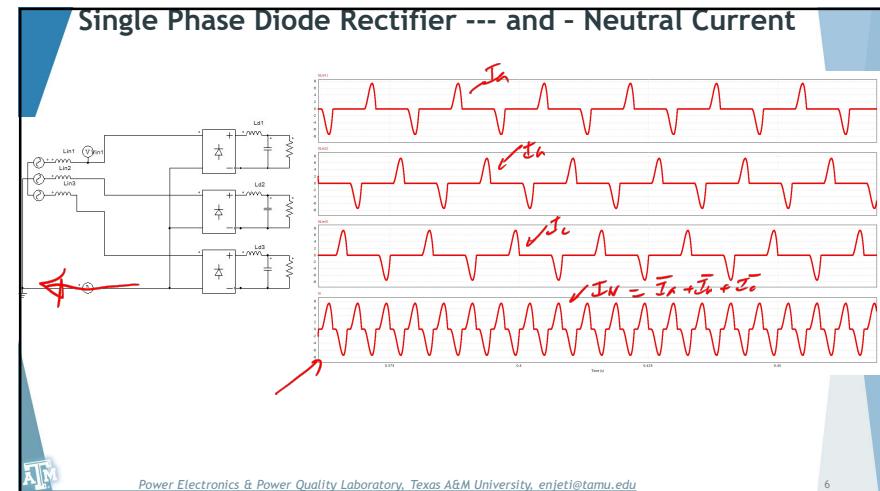
➤ Current only flows during the center portion of the input sine wave

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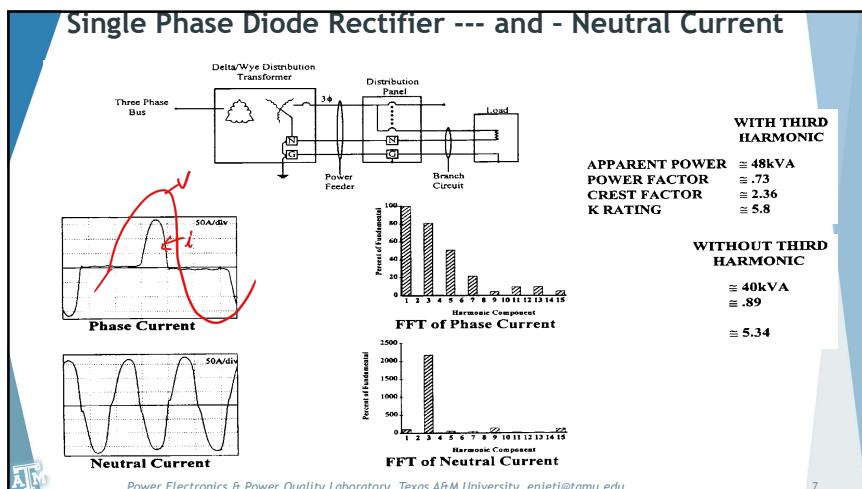
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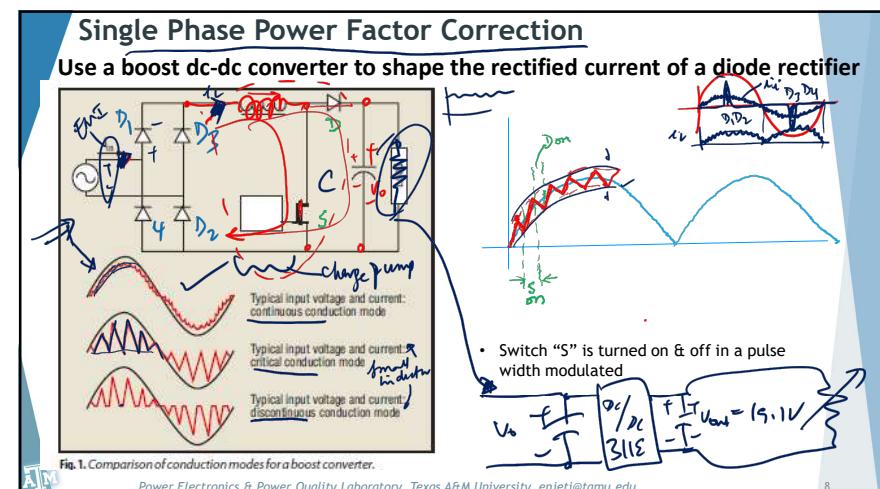
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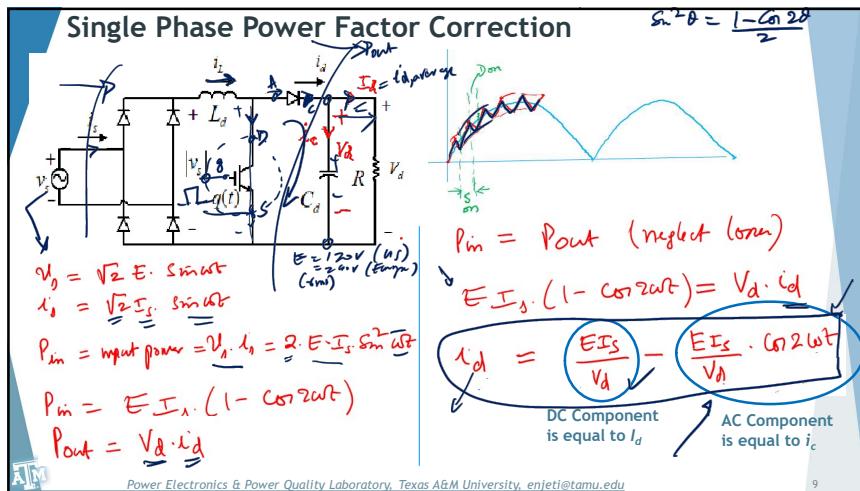
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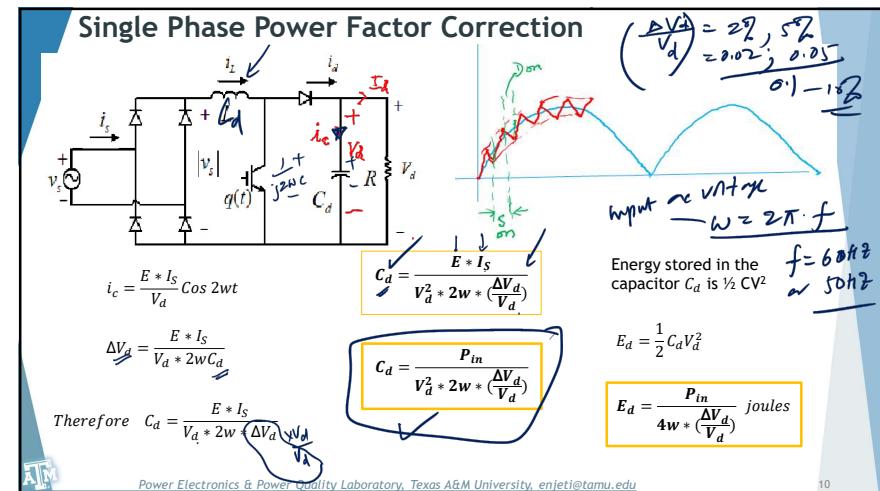
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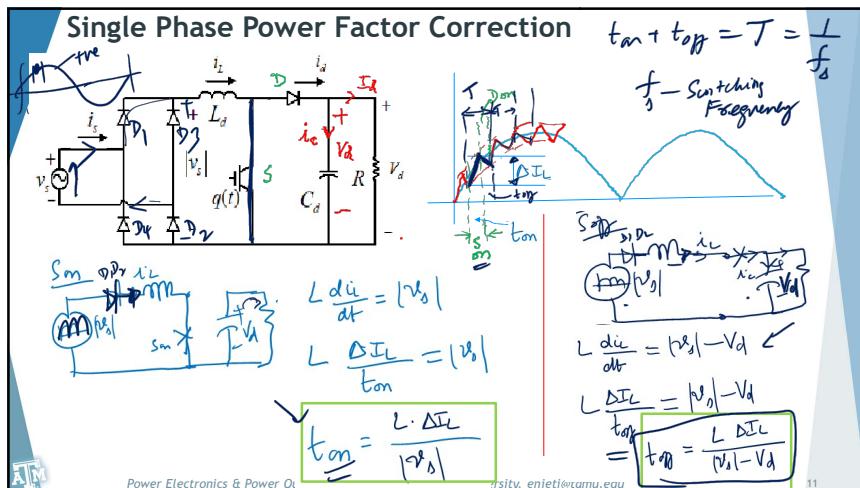
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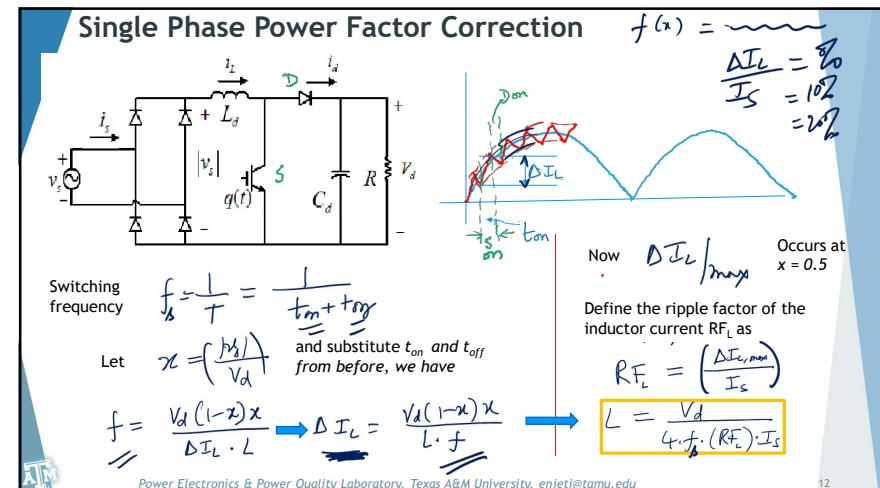
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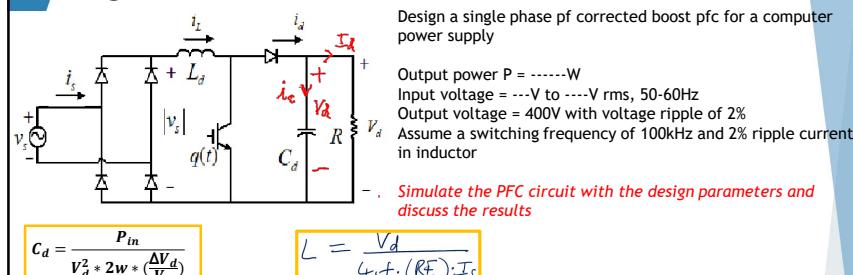


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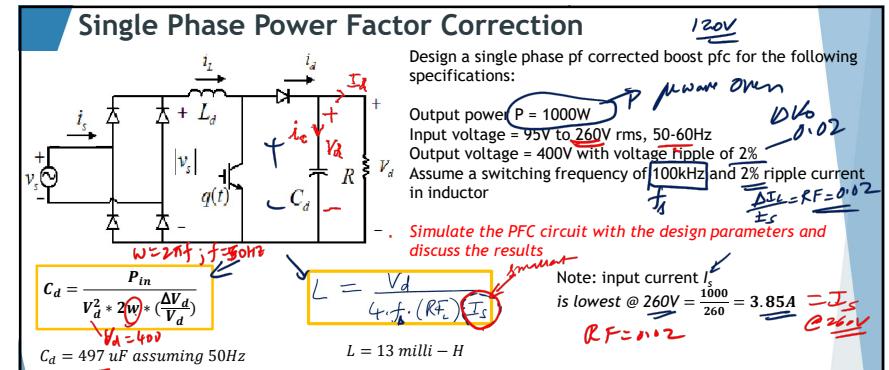
## Single Phase Power Factor Correction



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## Single Phase Power Factor Correction



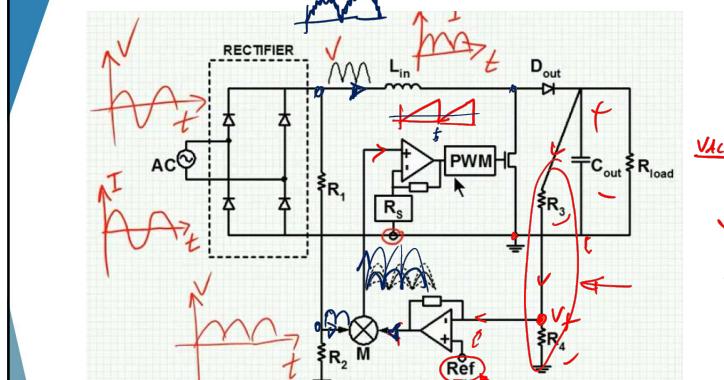
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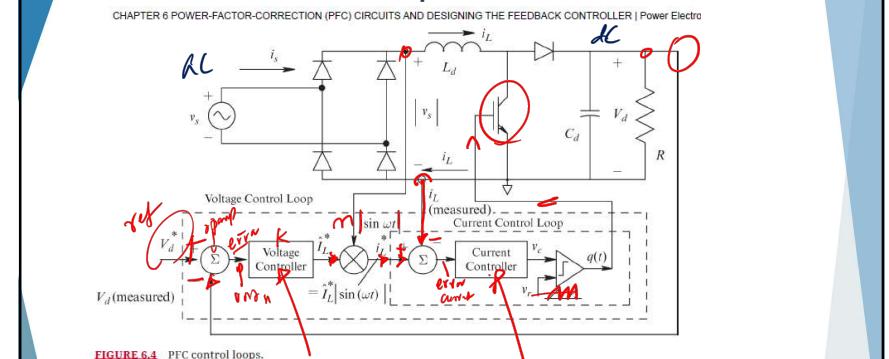
## Single Phase Power Factor Correction - Closed loop Operation



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## Single Phase Power Factor Correction - Closed loop Operation

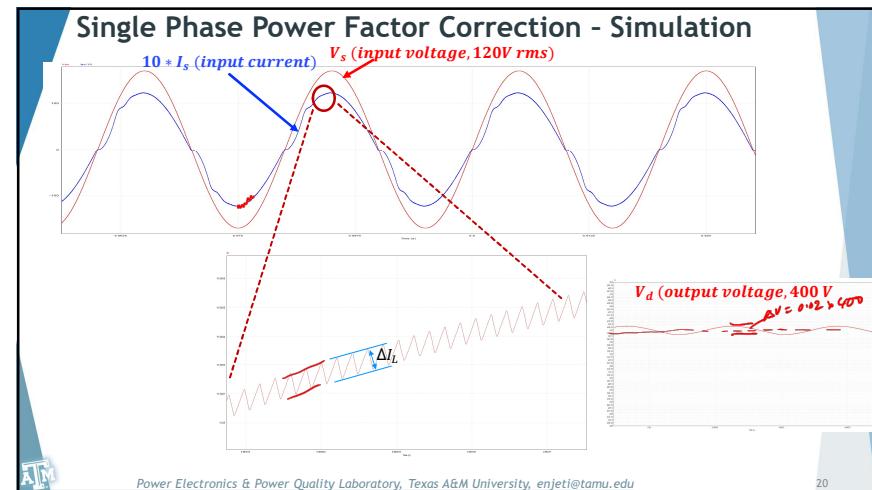
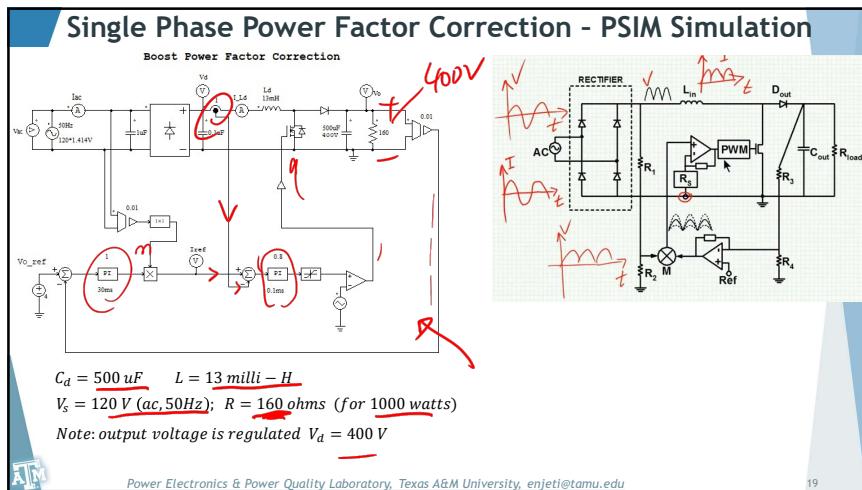
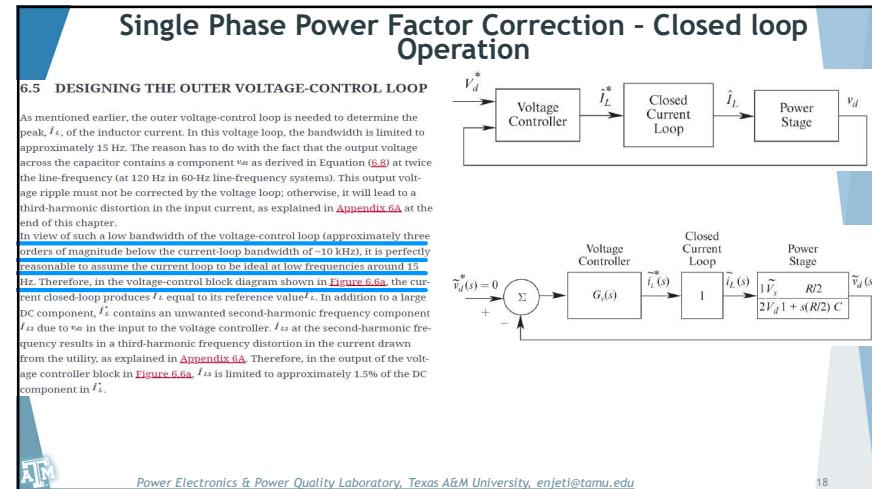
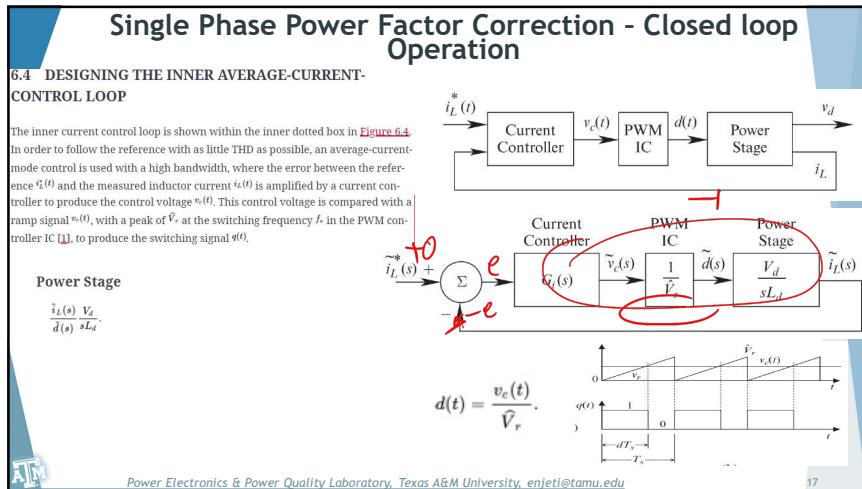


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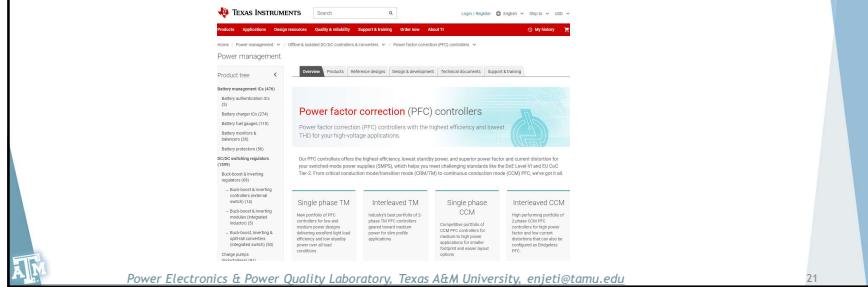
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# TI - Power factor correction (PFC) controllers

<http://www.ti.com/power-management/offline-isolated-dcdc-controllers-convertisers/power-factor-correction-pfc-controllers/overview.html>

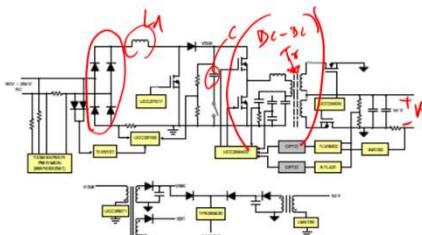


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# TI - Power factor correction (PFC)

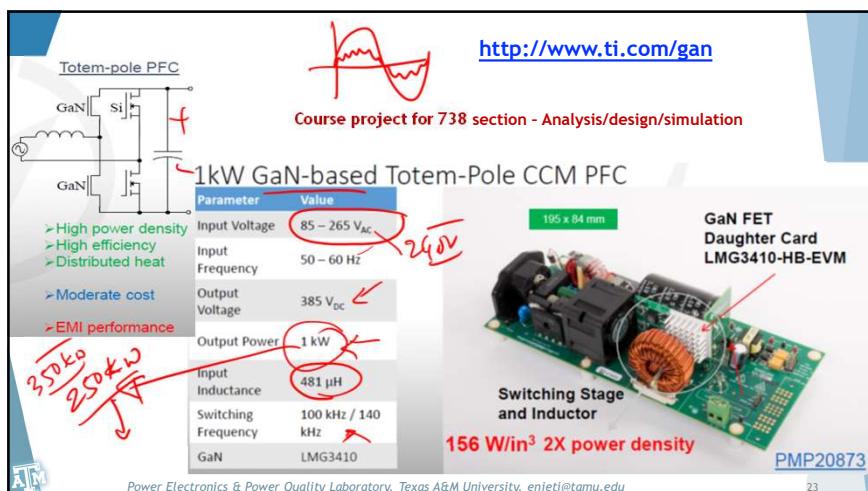
## Reference Designs

<http://www.ti.com/lit/ug/tiduet4a/tiduet4a.pdf>



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