

ECET 211 Electric Machines & Controls

Lecture 9

Motor Control Electronics

Text Book: Electric Motors and Control Systems, by Frank D. Petruzella, published by McGraw Hill, 2015.

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1

Motor Control Electronics

- **A Quick Overview of Power Electronics (Chapter 9)**
 - Diodes, Transistors, Thyristors and ICs
- **Solid-State Switch**
- **Rectifiers**

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2

A Quick Overview

A Quick Overview of Motor Control Electronics (Chapter 9)

- Semiconductor Didoes
 - Rectifier Diode
 - Zener Diode
 - Light-Emitting Diode
 - Photodiodes
- Transistors
- Thyristors
- ICs

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3

A Quick Overview of Power Electronics

A Quick Overview of Motor Control Electronics (Chapter 9)

- Semiconductor Didoes: Rectifier Diode, Zener Diode, Light-Emitting Diode
 - Photodiodes
- Figure 9-1 PN-Junction Diode

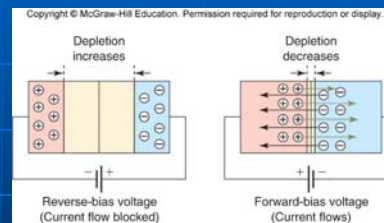
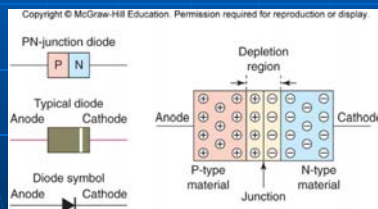


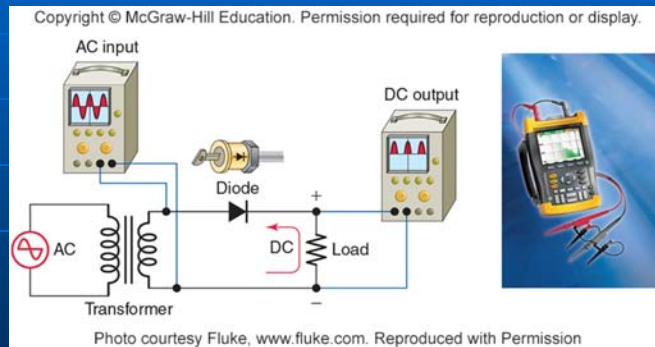
Figure 9-2 Diode forward and reverse biasing

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4

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- Figure 9-3 Single-phase, half-wave rectifier circuit

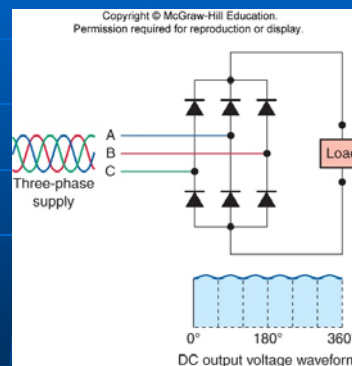
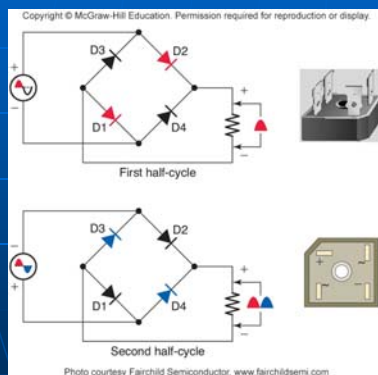


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5

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- Figure 9-5 Single-phase, full-wave rectifier circuit
- Figure 9-7 Three-phase, full-bridge rectifier

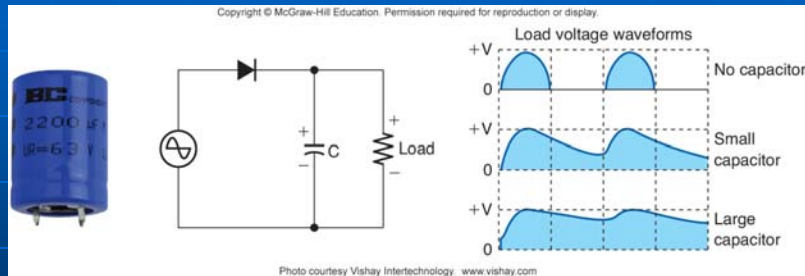


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- Figure 9-6 Capacitor filter



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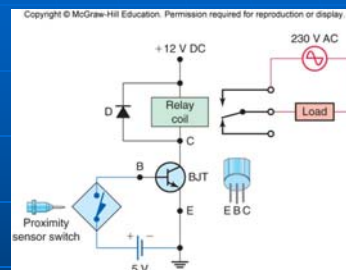
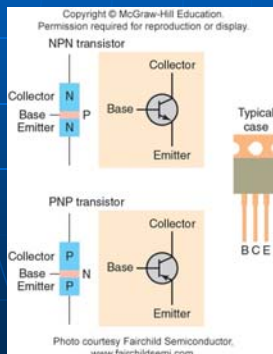
7

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Transistors

- Bipolar Junction Transistor (BJT)
- Figure 9-14 Bipolar junction transistor

- Figure 9-16 BJT switching of an AC load



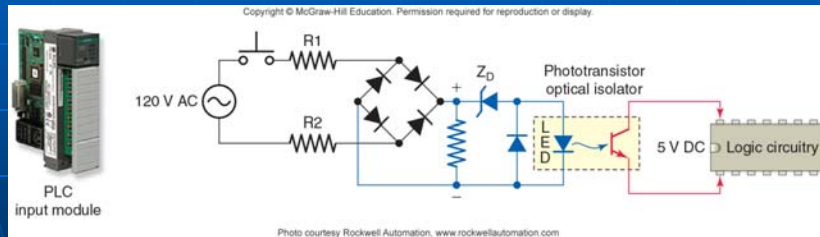
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Transistors

- Figure 9-18 Phototransistor employed as part of an optical isolator found in a programmable logic controller (PLC) AC input module circuit



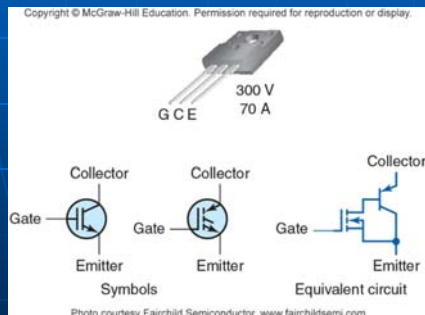
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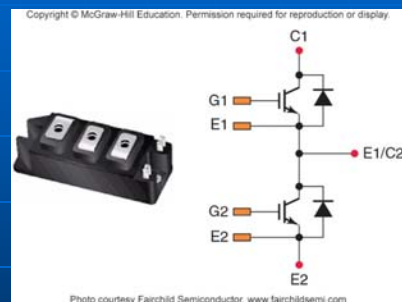
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Insulated-Gate Bipolar Transistor (IGBT)

- Figure 9-26 Insulated-gate BJT – N type



- Figure 9-27 IGBT power module

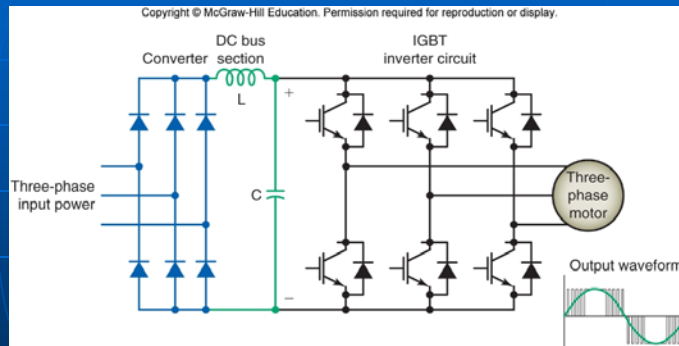


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10

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- Figure 9-28 IGBT used in an electronic motor drive



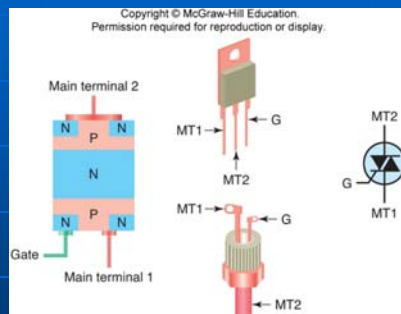
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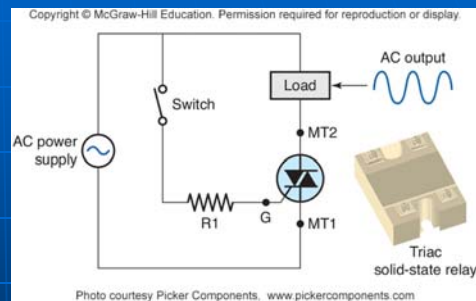
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TRIAC

- Figure 9-35 Triac



- Figure 9-36 Triac switching circuit



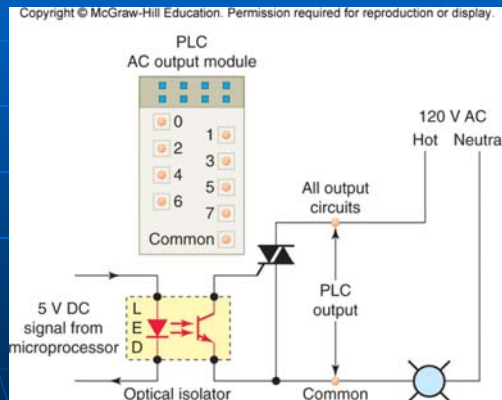
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12

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TRIAC

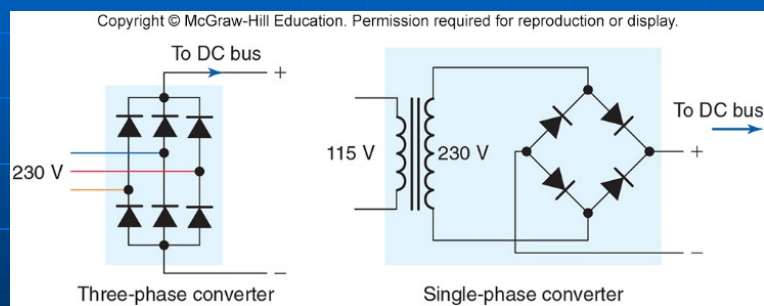
- Figure 9-37 Triac switching of PLC output module



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13

- Figure 10-3 Three-phase and single-phase converter input connections

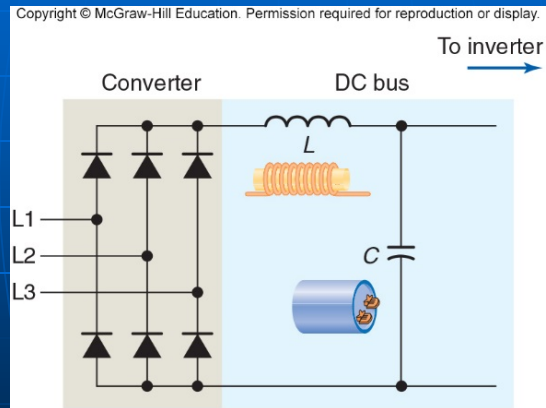


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14

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- Figure 10-4 Inductor and capacitor connections within the DC bus

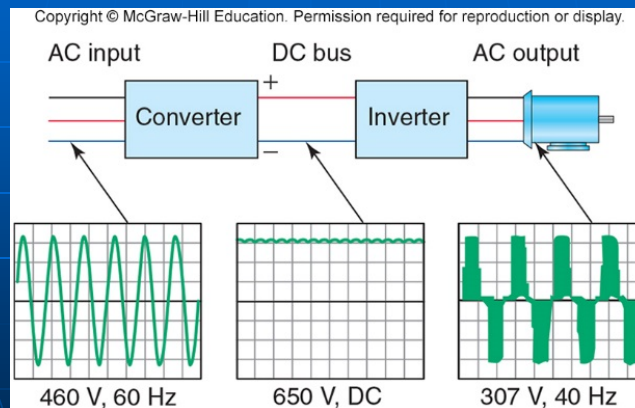


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15

Ch 10. Adjustable-Speed Drives and PLC Installations

- Figure 10-5 Typical VFD voltage measurement

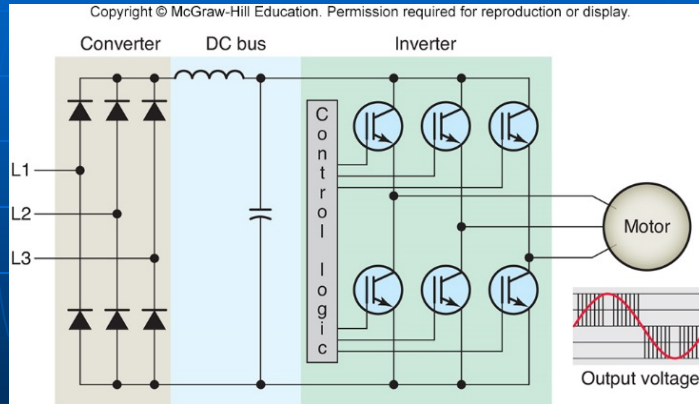


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16

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- Figure 10-6 The three sections of a variable-speed drive

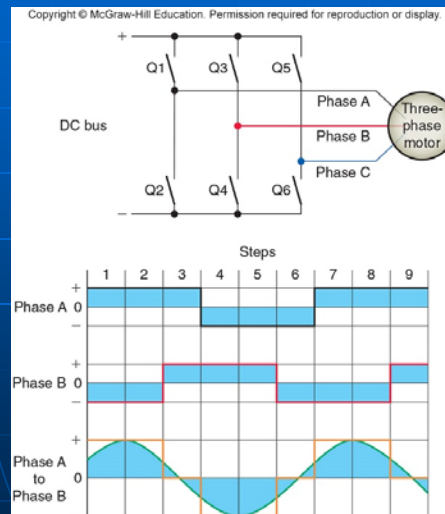


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17

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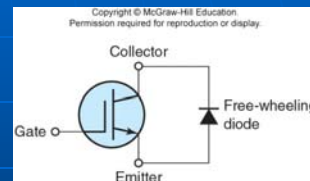
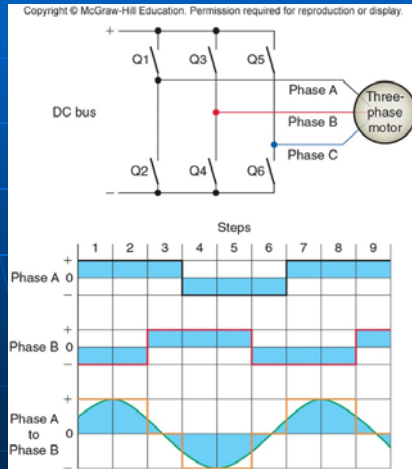
- Figure 10-7 Simplified circuit of a PWM inverter



18

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- Figure 10-7 Simplified circuit of a PWM inverter
- Figure 10-8 IGBT switch element

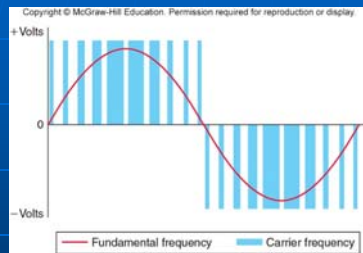


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19

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- Figure 10-9 Sine-wave line voltage superimposed on the PWM inverter output
- Figure 10-10 Inverter motor and control



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20

Summary & Conclusion

Questions?

Contact Prof. Lin through:

- Email: lin@ipfw.edu