

Direct Memory Access and DMA-Controlled I/O

In this chapter, examples and detailed explanations of the DMA I/O techniques used in PC systems are provided including those using Intel family of microprocessors.

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Objectives

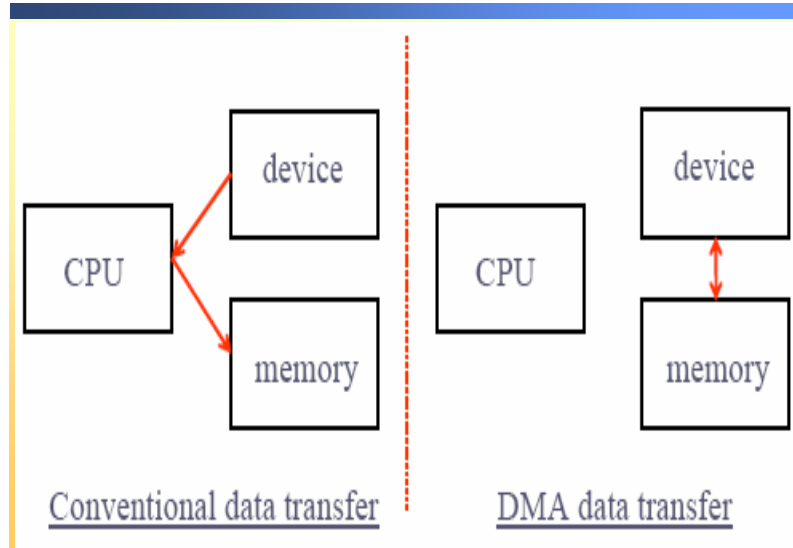
Upon completion of this chapter, you will be able to

- Describe a DMA transfer.
- Explain the operation of the HOLD and HLDA direct memory access control signals.
- Explain the function of the 8237 DMA controller when used for DMA transfers.
- Program the 8237 to accomplish DMA transfer.

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Basic DMA Operations



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Basic DMA Operations

- The **direct memory access (DMA)** I/O technique provides direct access to the memory while the microprocessor is temporarily disabled.
- A DMA controller temporarily
 - borrows the address bus, data bus, and control bus from the microprocessor and
 - transfers the data bytes directly between an I/O port and a series of memory locations.
- The DMA transfer is also used to do high-speed memory-to-memory transfers.

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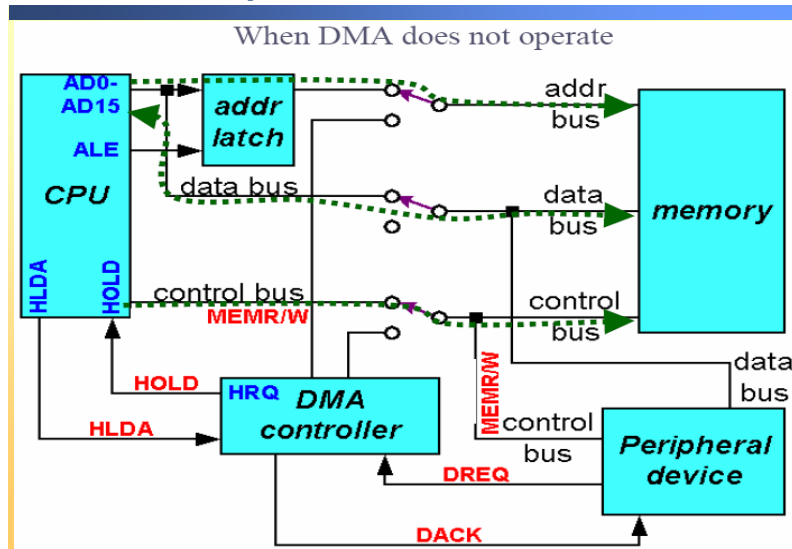
Basic DMA Operations

- Two control signals are used to request and acknowledge a DMA transfer in the microprocessor-based system.
- The **HOLD** signal is a **bus request signal** which asks the microprocessor to release control of the buses after the current bus cycle.
- The **HLDA** signal is a **bus grant signal** which indicates that the microprocessor has indeed released control of its buses by placing the buses at their high-impedance states.
- The HOLD input has a **higher priority** than the INTR or NMI interrupt inputs.

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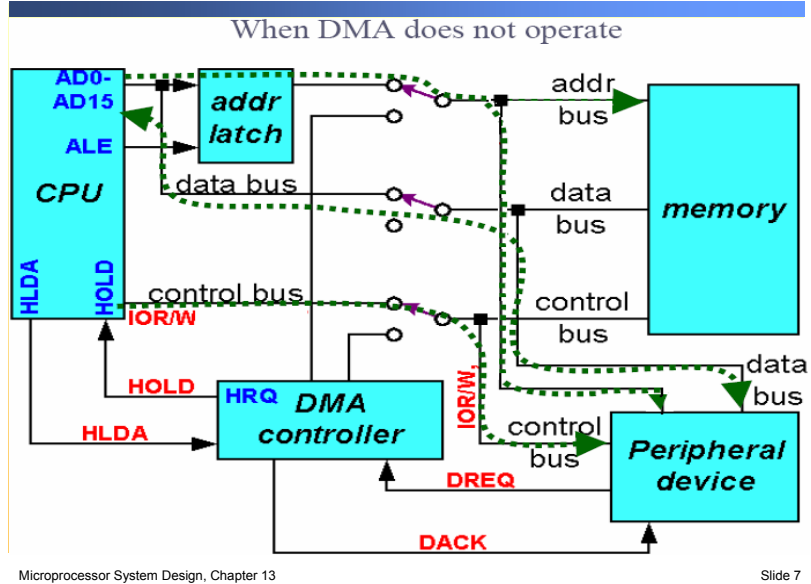
Basic DMA Operations



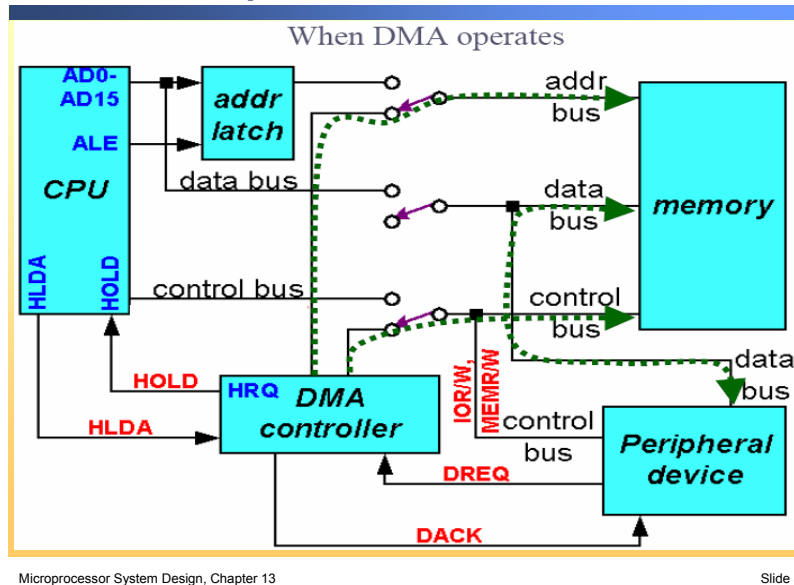
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Basic DMA Operations



Basic DMA Operations



Example of Memory-to-Device Transfer

