

Subject: Microprocessors

8086/8088 Hardware Specifications

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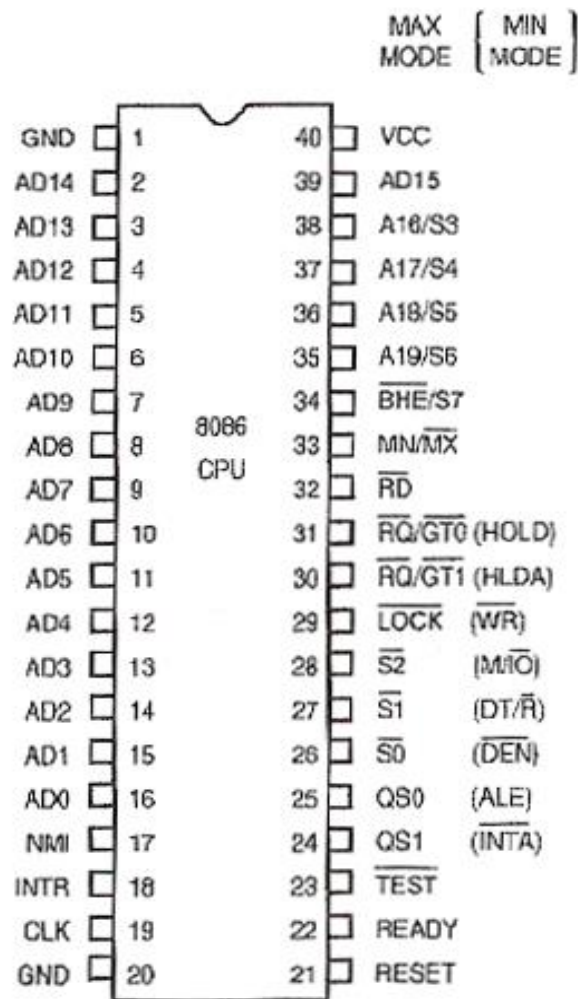
9–1 PIN-OUTS AND THE PIN FUNCTIONS

- In this section, we explain the function and the multiple functions of each of the microprocessor's pins.
- In addition, we discuss the DC characteristics to provide a basis for understanding the later sections on buffering and latching.

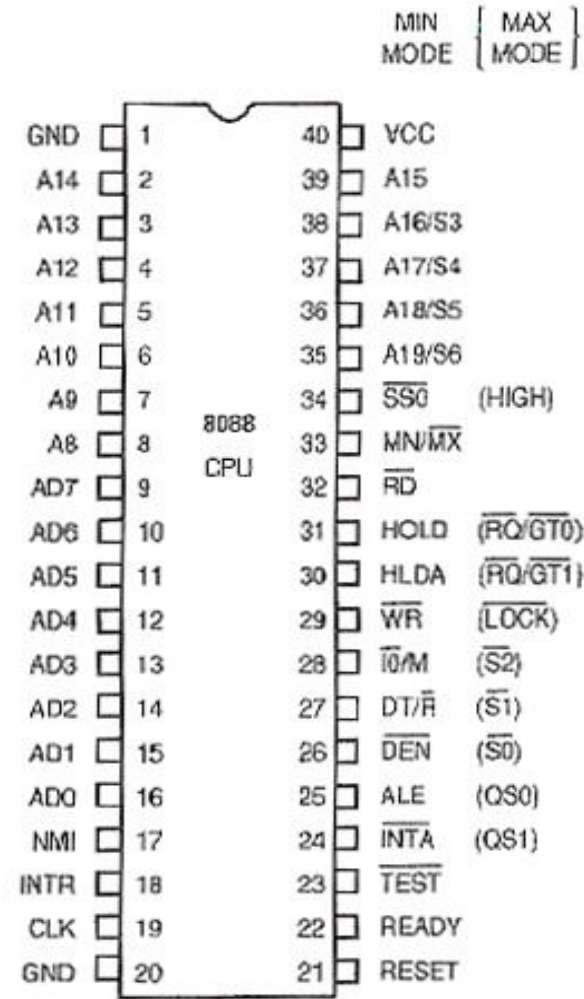
The Pin-Out

- Figure 9–1 illustrates pin-outs of 8086 & 8088.
 - both are packaged in 40-pin **dual in-line** packages (DIPs)
- 8086 is a 16-bit microprocessor with a **16**-bit data bus; 8088 has an **8**-bit data bus.
 - 8086 has pin connections AD_0-AD_{15}
 - 8088 has pin connections AD_0-AD_7
- Data bus width is the only major difference.
 - thus 8086 transfers 16-bit data more efficiently

Pin out of the 8086 and 8088 Microprocessor

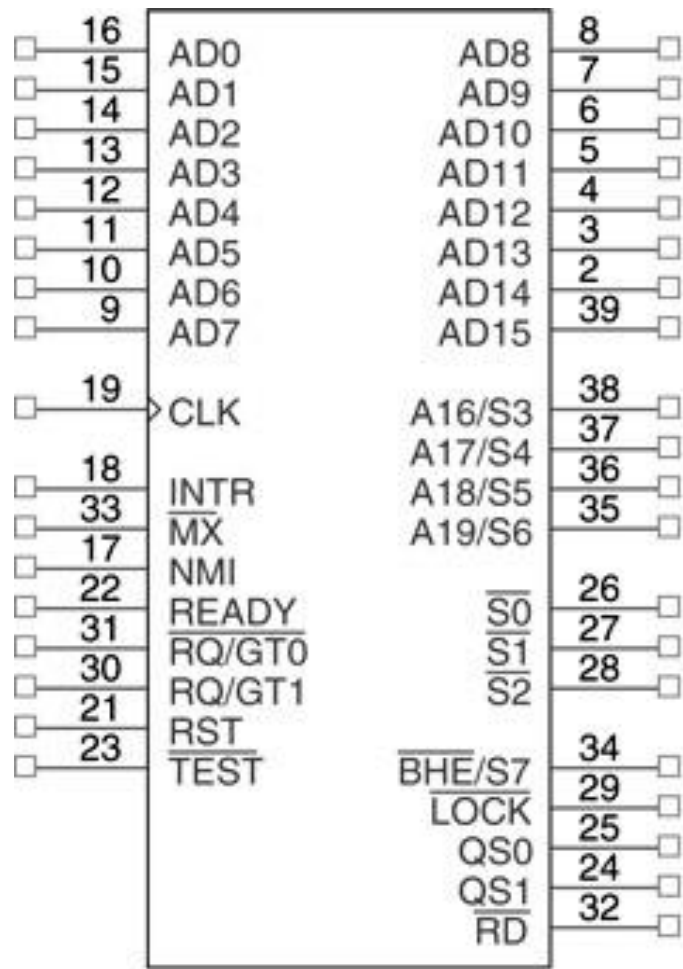


(a)



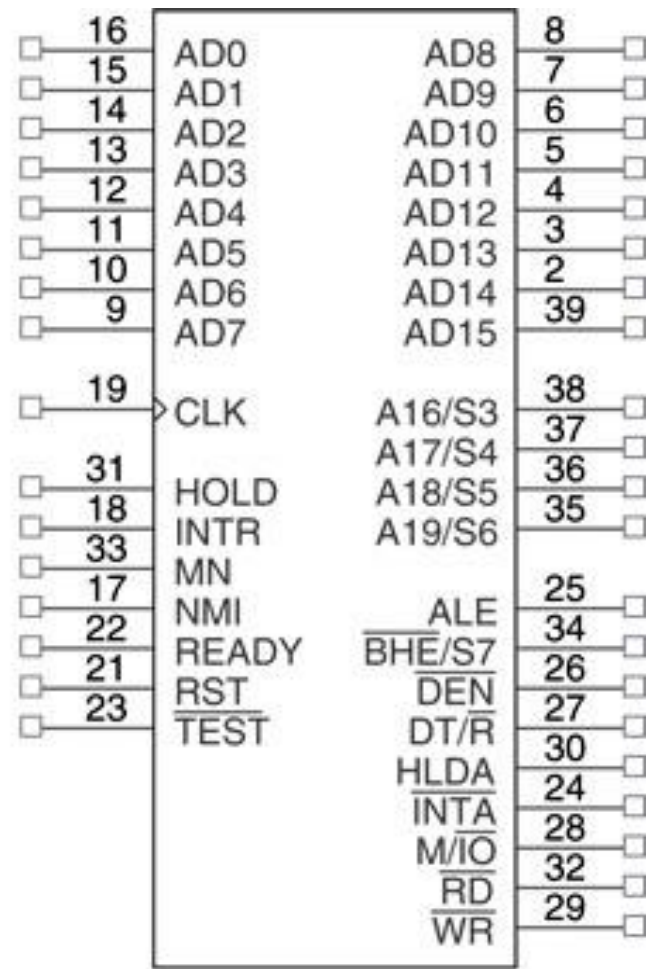
(b)

**Figure 9–1 (a) The pin-out of the 8086 in maximum mode;
 (b) the pin-out of the 8086 in minimum mode.**



8086MAX

(a)



8086MIN

(b)

Power Supply Requirements

- Both microprocessors require **+5.0 V** with a supply voltage tolerance of **±10** percent.
 - 8086 uses a maximum supply current of **360 mA**
 - 8088 draws a maximum of **340 mA**
- Both microprocessors operate in ambient temperatures of between **32° F** and **180° F**.
- 80C88 and 80C86 are **CMOS** versions that require only **10 mA** of power supply current.
 - and function in temperature extremes of **-40° F** through **+225° F**

DC Characteristics

- It is impossible to connect anything to a microprocessor without knowing **input current** requirement for an **input pin**.
 - and the output current **drive capability** for an **output pin** (**Fanout**)
- This knowledge allows hardware designers to select proper interface components for use with the microprocessor
 - without the fear of damaging anything

Input Characteristics

- Input characteristics of these microprocessors are compatible with all the standard logic components available today.
- Table 9–1 depicts input voltage levels and the input current requirements for any input pin on either microprocessor.
- The input current levels are very small because the inputs are the gate connections of **MOSFETs** and represent only leakage currents.

Output Characteristics

- Table 9–2 illustrates output characteristics of all the output pins of these microprocessors.
- The **logic 1** voltage level of the 8086/8088 is **compatible** with most standard logic families.
 - **logic 0** level is **not**
- Standard logic circuits have a maximum **logic 0** voltage of **0.4 V**; 8086/8088 has a maximum of **0.45 V**.
 - a difference of **0.05 V**

8086/88 Input and Output Characteristics

Input characteristics of 8086/88

Logic Level	Voltage	Current
0	0.45 V maximum	2.0 mA maximum
1	2.4 V minimum	-400 μ A maximum

output characteristics of 8086/88

Logic Level	Voltage	Current
0	0.8 V maximum	+10 μ A maximum
1	2.0 V minimum	+10 μ A maximum

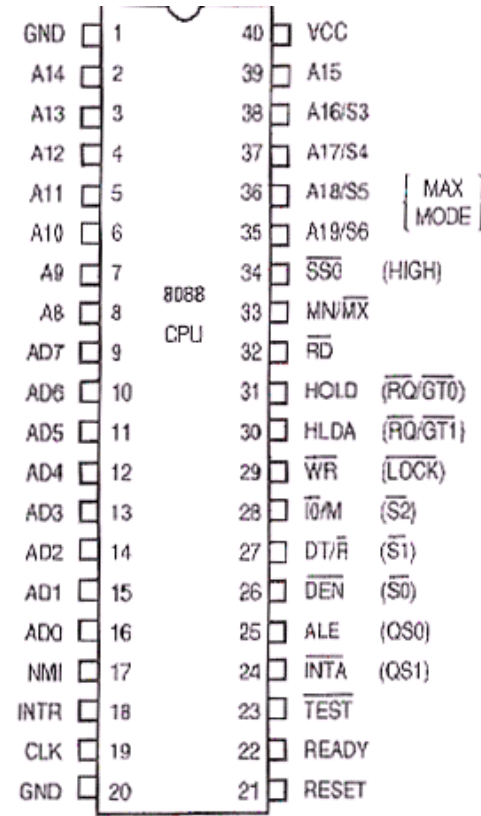
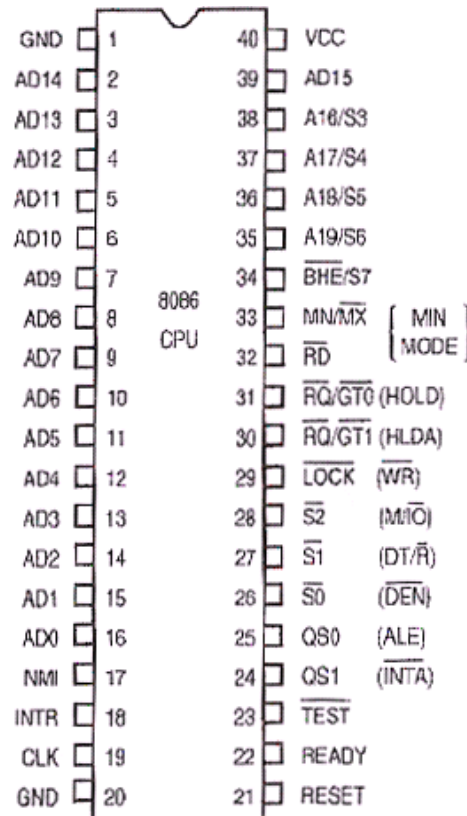
Pin Connections $AD_7 - AD_0$

- 8088 **address/data bus** lines are **multiplexed**
 - and contain the **rightmost 8 bits** (Lower-half) of the **memory address** or **I/O port number** whenever **ALE** (Address Latch Enable) is active (**logic 1**)
 - or **data** whenever **ALE** is inactive (**logic 0**)
- These pins are at their **high-impedance** state during a **hold acknowledge**.

Pin Connections $A_{15} - A_8$

- 8088 **address bus** provides the **upper-half** memory address bits that are present throughout a bus cycle.
- These address connections go to their **high-impedance** state during a **hold acknowledge**.

S_4	S_3	Characteristics
0 (LOW)	0	Alternate Data (extra segment)
0	1	Stack
1 (HIGH)	0	Code or None
1	1	Data



Pin Connections

- **READ**- When **read signal** is logic 0, the data bus is **receptive** to data **from** memory or **I/O** devices
 - pin floats **high-impedance** state during a **hold acknowledge**
- **Ready-Inserts** wait states into the timing.
 - if placed at a logic **0**, the microprocessor **enters** into **wait states** and remains **idle**
 - if logic **1**, no effect on the operation
- **Interrupt request** is used to request a **hardware** interrupt.
 - If **INTR** is held **high** when **IF = 1**, 8086/8088 enters an **interrupt acknowledge cycle** after the current instruction has completed execution

Pin Connections

- **The non-maskable interrupt** input is similar to INTR.
 - does not check IF flag bit for logic 1
- if **The Test** pin is an input that is tested by the WAIT instruction.
 - a) If TEST is a logic 0, the WAIT instruction functions as an NOP.
 - b) If TEST is a logic 1, the WAIT instruction waits for TEST to become a logic 0.
 - c) The TEST pin is most often connected to the 8087 numeric coprocessor.
- **RESET**-Causes the microprocessor to reset itself if held high a minimum of four clocking periods.
 - when 8086/8088 is reset, it executes instructions at memory location FFFF0H
 - also disables future interrupts by clearing IF flag

Pin Connections

- The **clock pin** provides the basic **timing signal**.
 - must have a **duty cycle** of **33 %** (high for one third of clocking period, low for two thirds) to provide proper internal timing
- **VCC**-This **power supply** input provides a **+5.0 V**, **±10 %** signal to the microprocessor.
- **GND**-The **ground** connection is the return for the power supply.
 - 8086/8088 microprocessors have **two** pins labeled **GND**—both must be connected to ground for proper operation
- **Minimum/maximum mode** pin selects either minimum or maximum mode operation.
 - if minimum mode selected, the MN/MX pin must be connected directly to +5.0 V
- The **bus high enable** pin is used in 8086 to enable the **most-significant** data bus bits (**D₁₅–D₈**) during a read or a write operation.
The state of **S₇** is always a logic **1**.