به نام خدا

میکروکنترلرها

خانواده AVR

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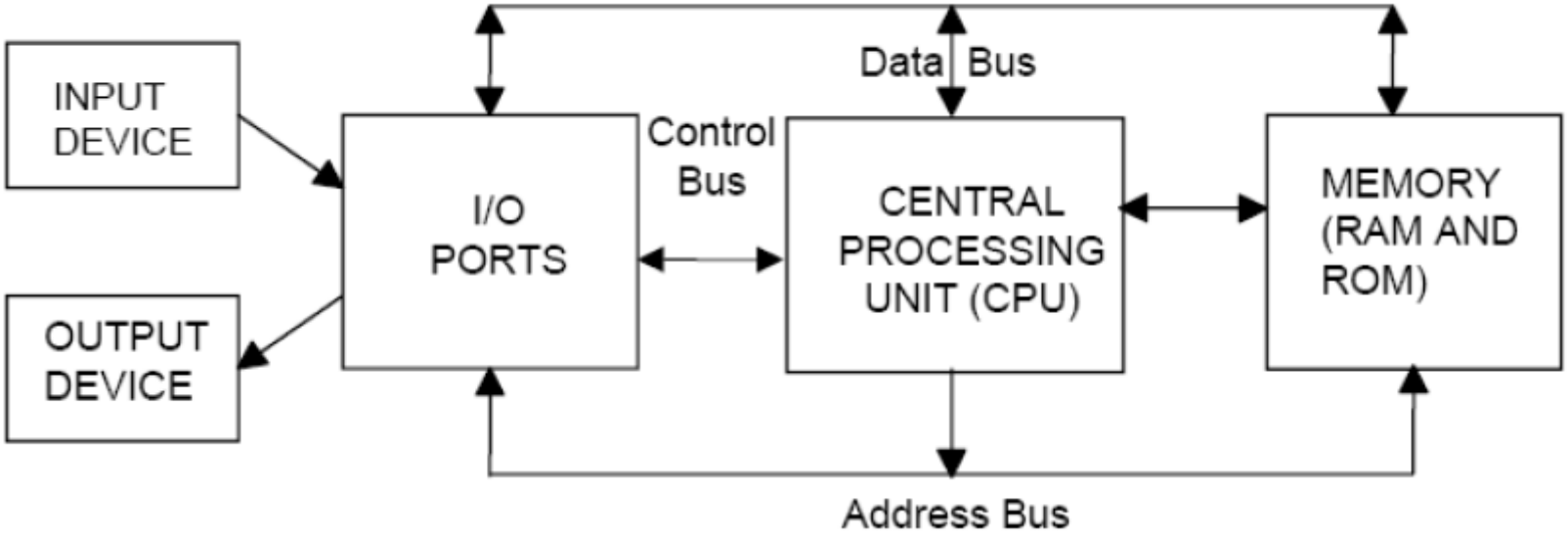
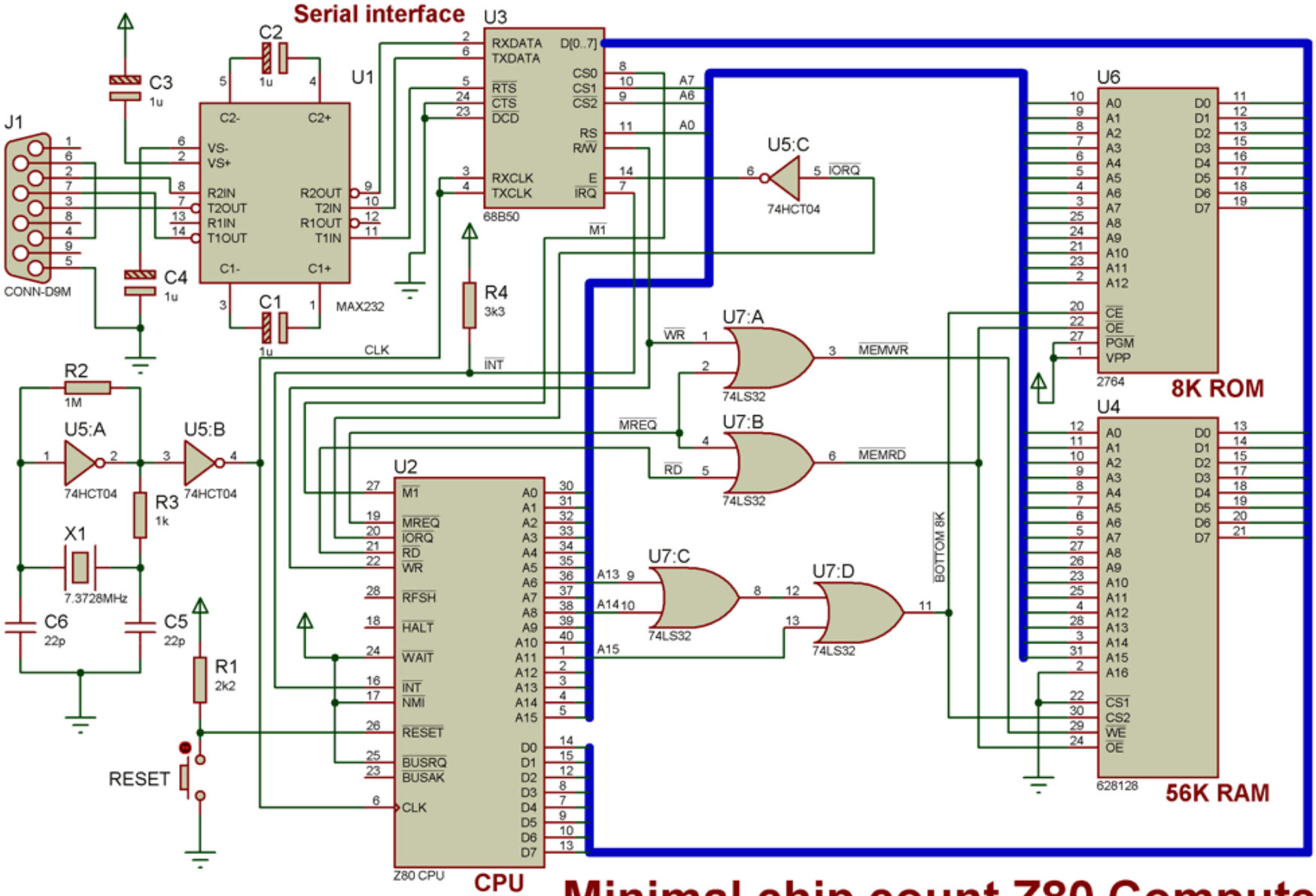
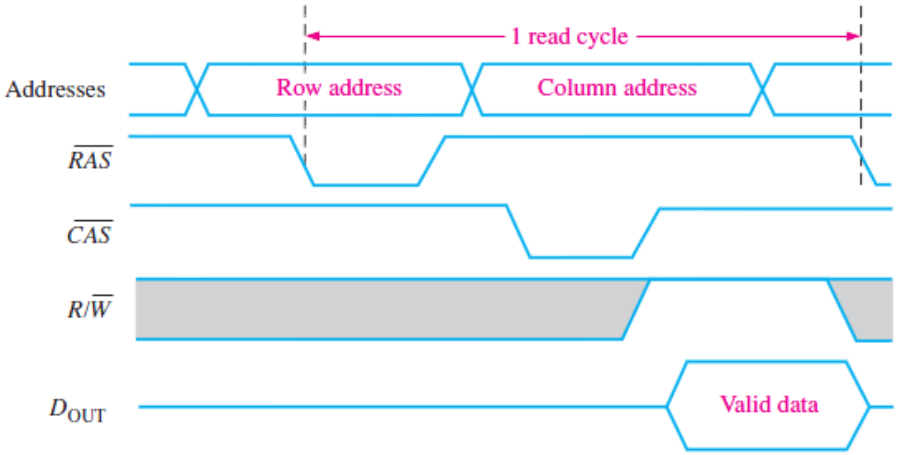
ساختار یک سیستم کامپیوتری

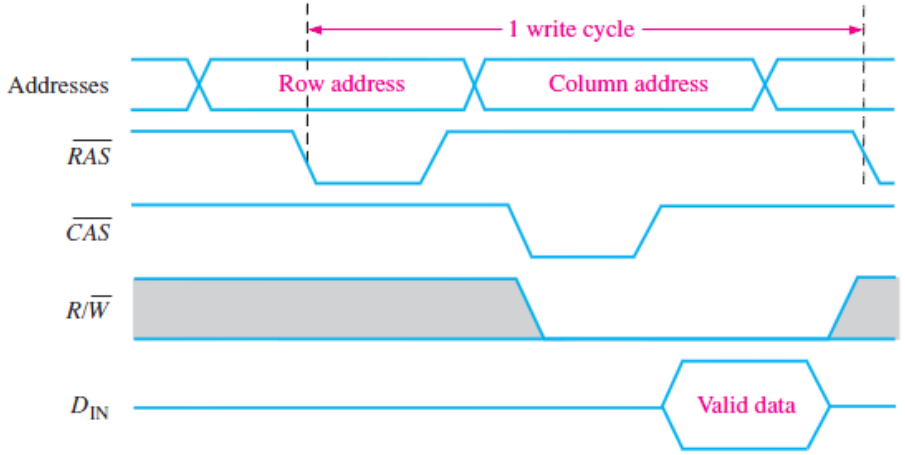


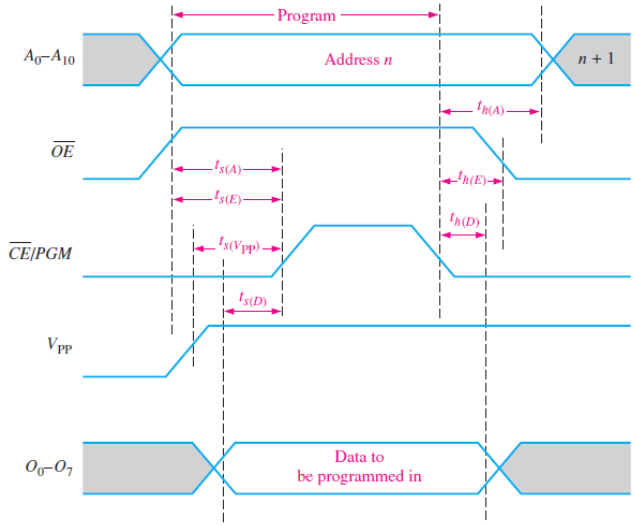


Minimal chip count Z80 Computer

زمانبندی‌های دقیق



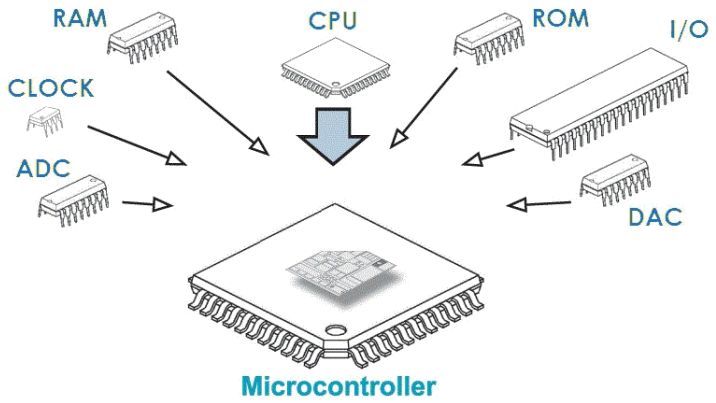


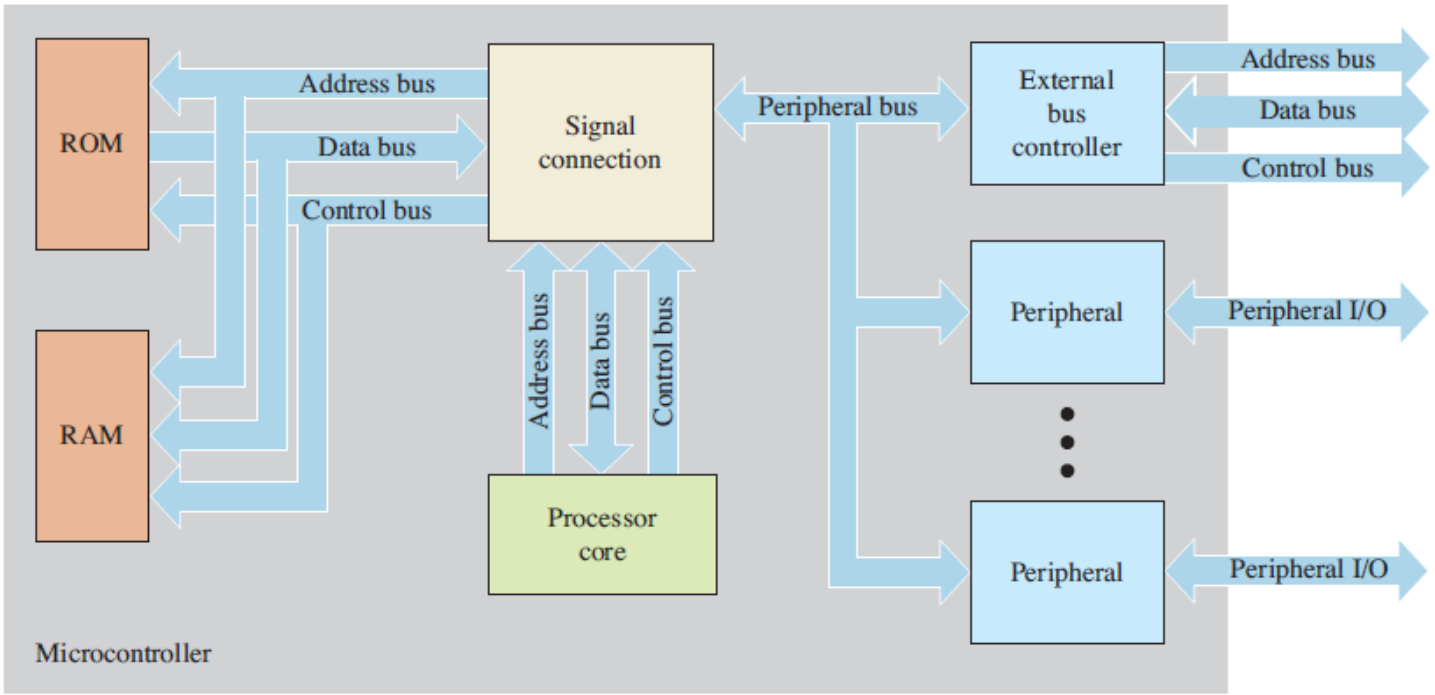


پردازش داده‌های دنیای واقعی

- Although a general-purpose microprocessor can interface with a variety of devices over its system buses
  - Its ability to interface with the real world is limited
- To process real world information, must use
  - Analog-to-digital converters (ADCs)
  - Digital-to-analog converters (DACs)
  - Universal asynchronous receiver and transmitter (UARTs)
  - External timers
  - Peripheral interface adaptors
  - Other specialized peripherals

میکروکنترلر





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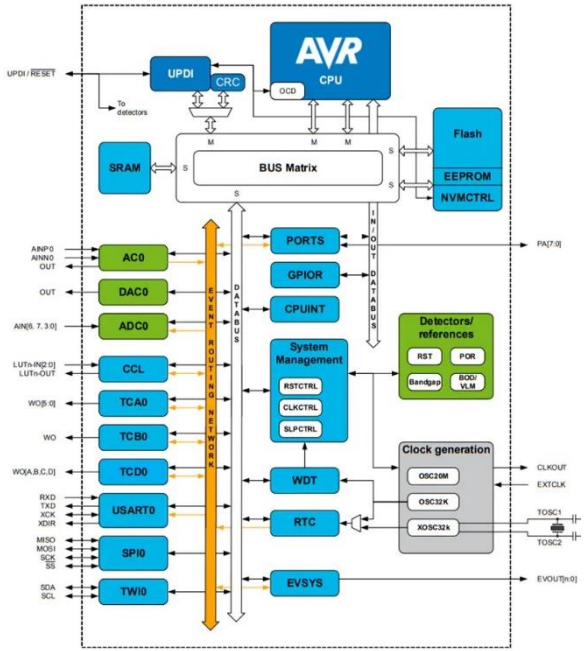
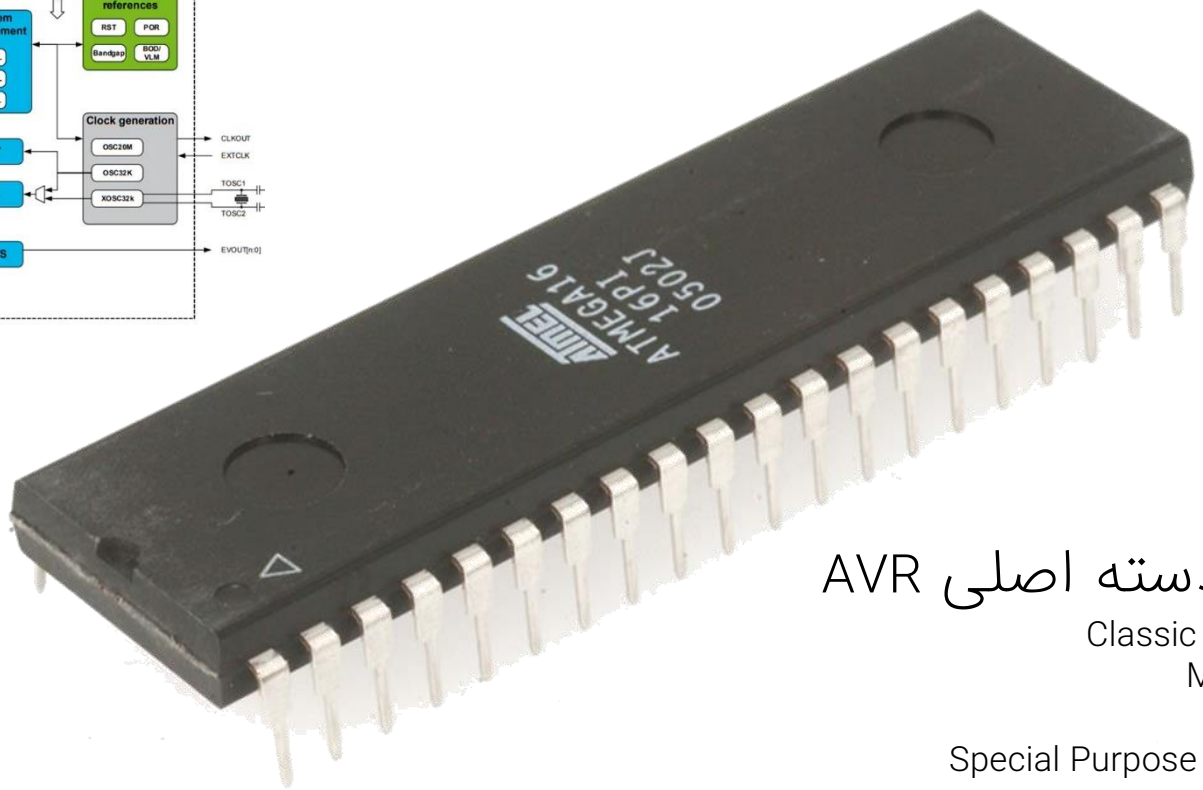
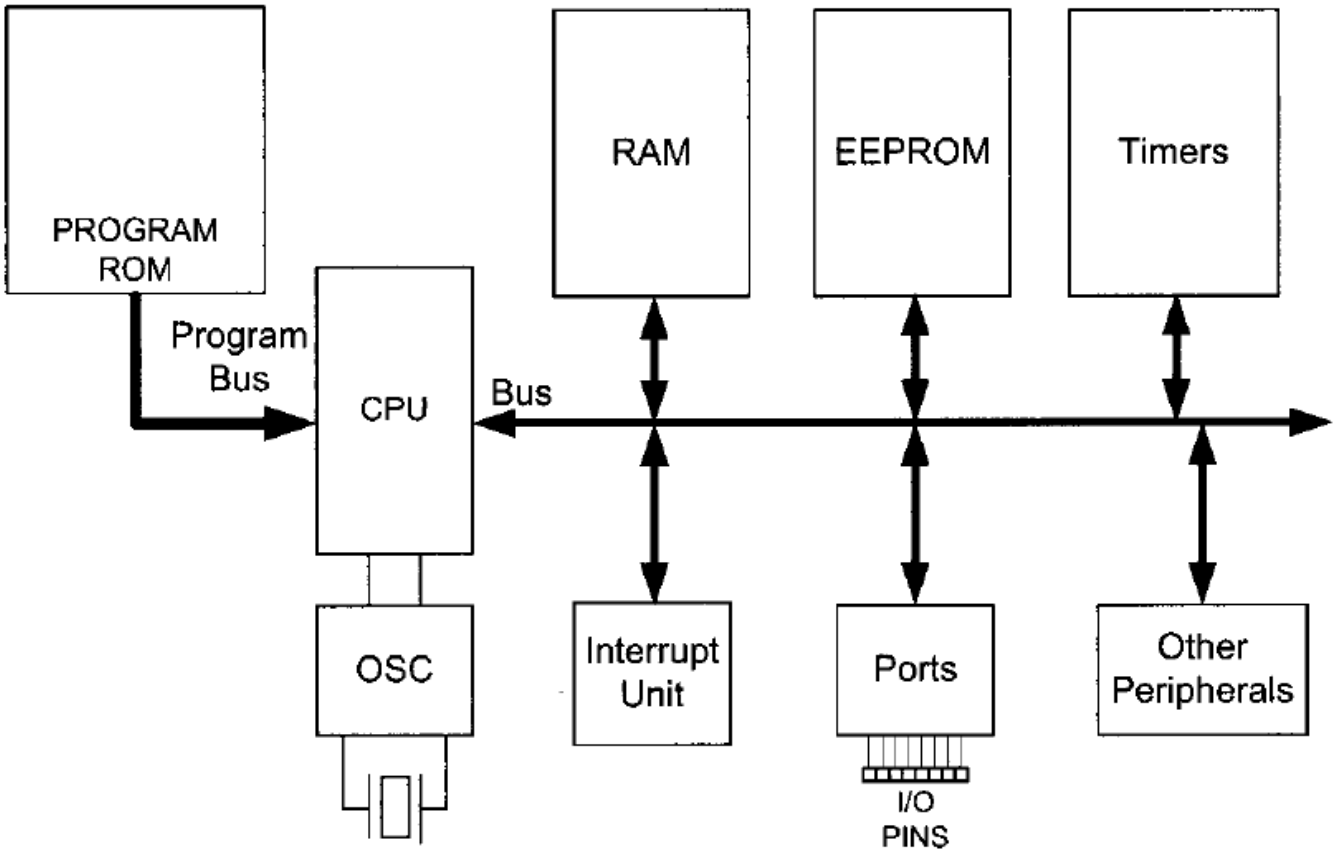


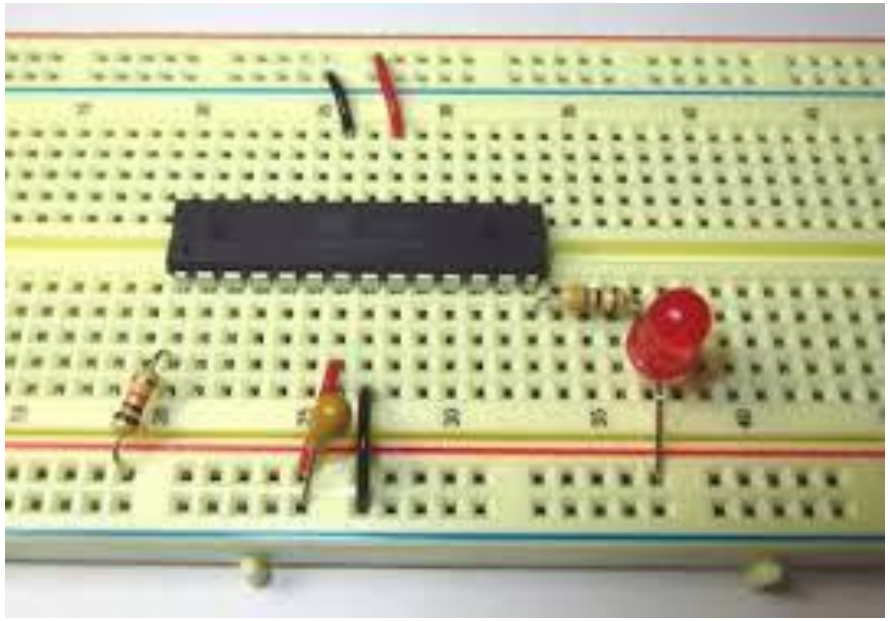


- چهار دسته اصلی AVR
  - Classic AVR
  - Mega
  - Tiny
  - Special Purpose AVR

نمای ساده از AVR



حداقل مدارات لازم برای راه اندازی AVR



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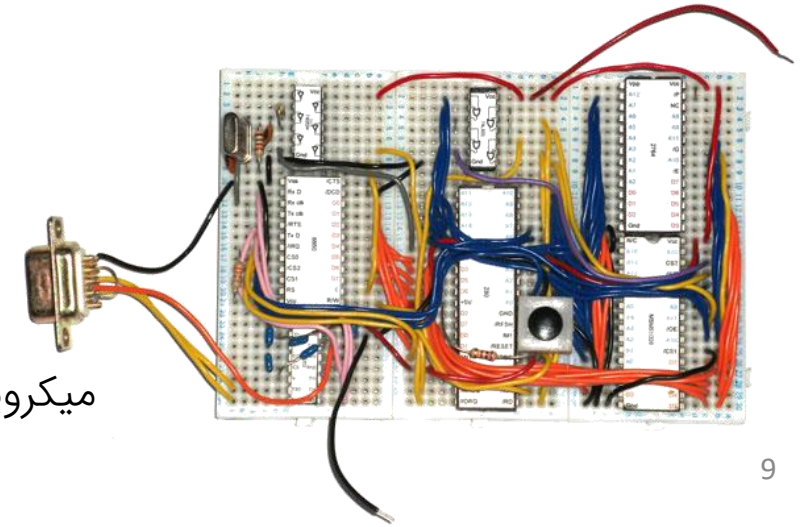
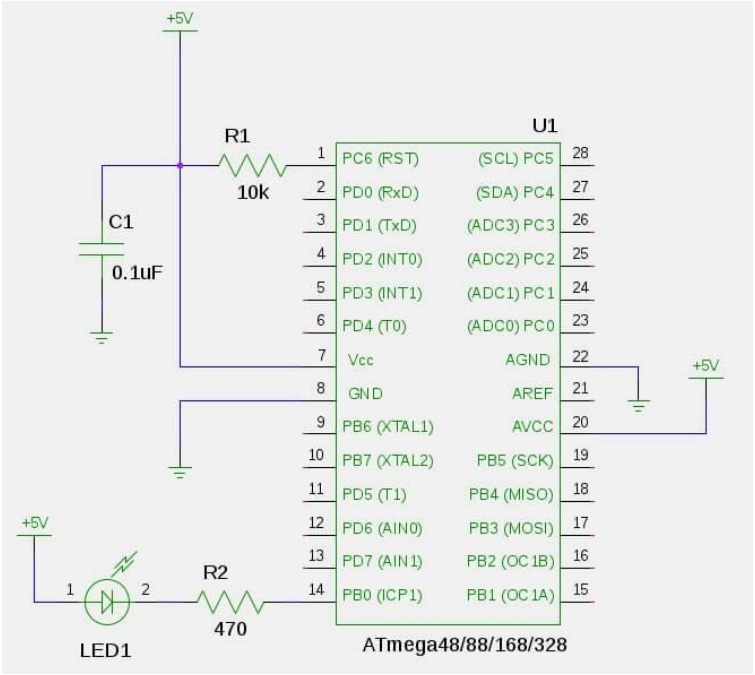


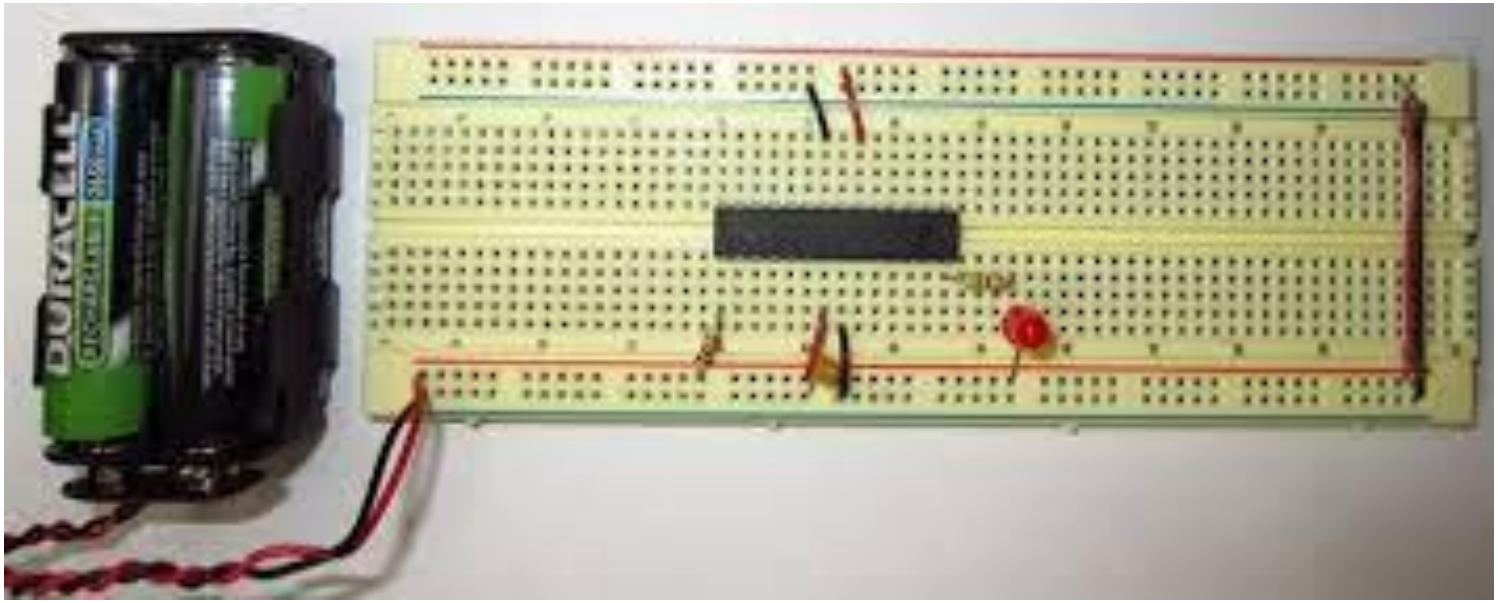
میکروپروسسور

حداقل مدارات لازم برای راه اندازی AVR

- A 10kΩ "pull-up resister" (R1) is connected to the RESET pin to keep the pin in a digital high state
- A 470Ω resistor (R2) and an LED (LED1) are connected to pin PB0
- The resistor is a "current limiting" resistor to limit the current (mA) passing through the LED so that it doesn't burn out
  - When PB0 goes low (0V) the LED will turn on
  - When PB0 goes high (+5V) the LED turns off
- A 0.1uF "bypass capacitor" (C1) helps prevent noise or "ripple" on the +5V line from effecting the microcontroller

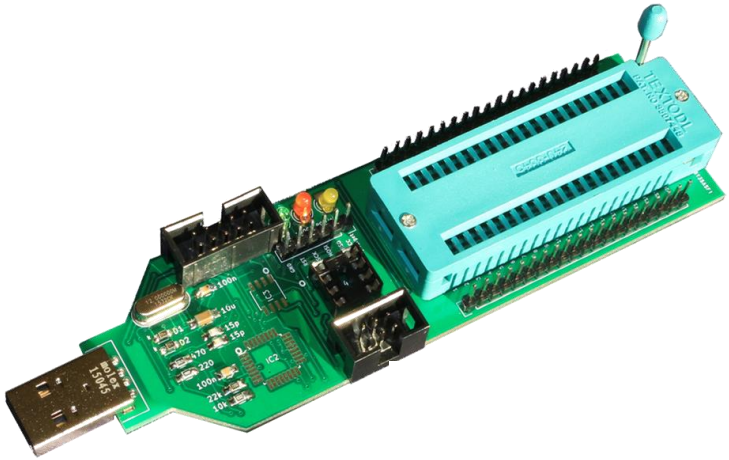


does not work!



کد برنامه باید توسط یک پروگرامر بر روی حافظه میکروکنترلر بارگذاری شود!

AVR Programmer

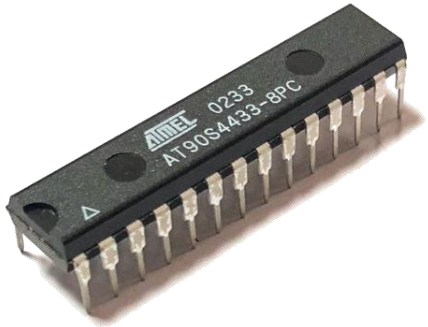


Classic AVR

- Classic AVR (AT90Sxxxx)
  - This is the original AVR chip
    - Has been replaced by newer AVR chips
  - These are not recommended for new designs

Some Members of the Classic Family

Part Num	Code ROM	Data RAM	Data EEPROM	I/O pins	ADC	Timers	Pin numbers & Package
AT90S2313	2K	128	128	15	0	2	SOIC20,PDIP20
AT90S2323	2K	128	128	3	0	1	SOIC8,PDIP8
AT90S4433	4K	128	256	20	6	2	TQFP32,PDIP28



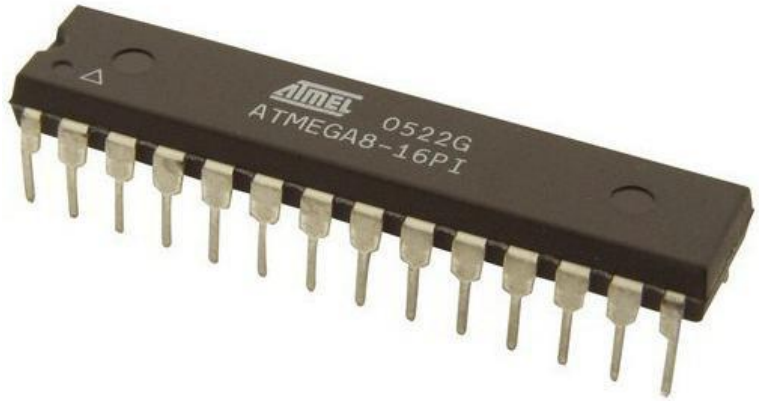
Mega AVR

- Mega AVR (ATmegaxxxx)
  - These are powerful microcontrollers with more than 120 instructions and lots of different peripheral capabilities, which can be used in different designs.
- Some of their characteristics are as follows:
  - Program memory: 4K to 256K bytes
  - Package: 28 to 100 pins
  - Extensive peripheral set
  - Extended instruction set: They have rich instruction sets.

Mega AVR

Some Members of the Mega Family

Part Num	Code ROM	Data RAM	Data EEPROM	I/O pins	ADC	Timers	Pin numbers & Package
ATmega8	8K	1K	0.5K	23	8	3	TQFP32,PDIP28
ATmega16	16K	1K	0.5K	32	8	3	TQFP44,PDIP40
ATmega32	32K	2K	1K	32	8	3	TQFP44,PDIP40
ATmega64	64K	4K	2K	54	8	4	TQFP64,MLF64
ATmega1280	128K	8K	4K	86	16	6	TQFP100,CBGA



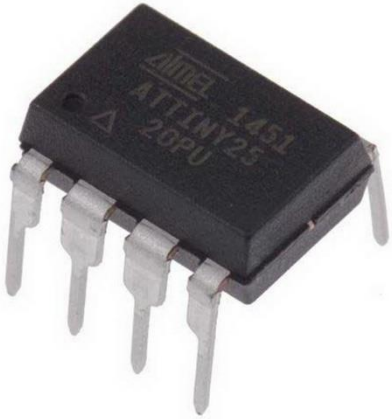
Tiny AVR

- Tiny AVR (ATtinyxxxx)
  - This group have less instructions and smaller packages in comparison to mega family. You can design systems with low costs and power consumptions using the Tiny AVRs.
- Some of their characteristics are as follows:
  - Program memory: IK to 8K bytes
  - Package: 8 to 28 pins
  - Limited peripheral set
  - Limited instruction set
  - For example, some of them do not have the multiply instruction

Tiny AVR

Some Members of the Tiny Family

Part Num	Code ROM	Data RAM	Data EEPROM	I/O pins pins	ADC	Timers	Pin numbers & Package
ATtiny13	1K	64	64	6	4	1	SOIC8,PDIP8
ATtiny25	2K	128	128	6	4	2	SOIC8,PDIP8
ATtiny44	4K	256	256	12	8	2	SOIC14,PDIP14
ATtiny84	8K	512	512	12	8	2	SOIC14,PDIP14



Special Purpose AVR

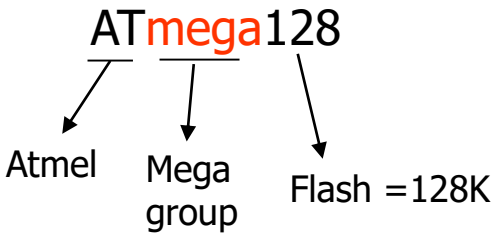
- Special purpose AVR
  - The ICs of this group can be considered as a subset of other groups
  - Their special capabilities are made for designing specific applications
  - Some of the special capabilities are:
    - USB controller
    - CAN controller
    - LCD controller
    - Zigbee
    - Ethernet controller
    - FPGA
    - Advanced PWM

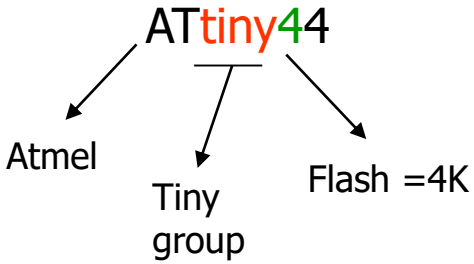
Special Purpose AVR

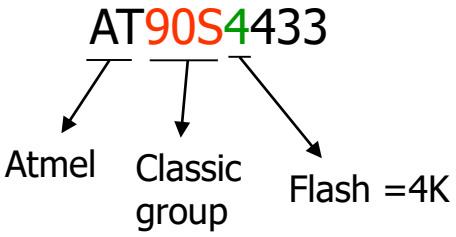
Some Members of the Special purpose Family

Part Num	Code ROM	Data RAM	Data EEPROM	Max I/O pins	Special Capabilities	Timers	Pin numbers & Package
AT90CAN128	128K	4K	4K	53	CAN	4	LQFP64
AT90USB1287	128K	8K	4K	48	USB Host	4	TQFP64
AT90PWM216	16K	1K	0.5K	19	Advanced PWM	2	SOIC24
ATmega169	16K	1K	0.5K	54	LCD	3	TQFP64,MLF64

AVR Part Numbers

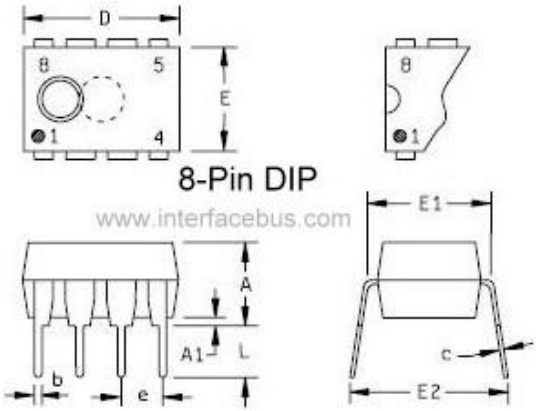






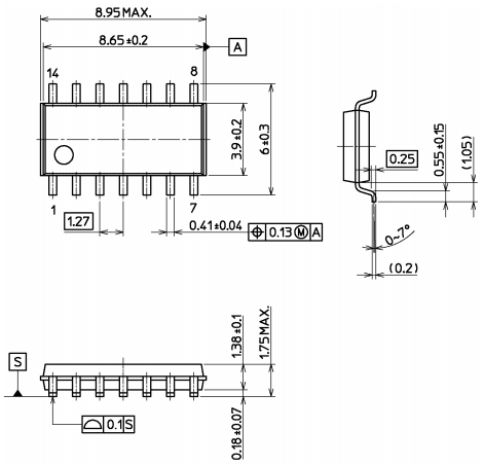
Packages

- Dual In-line Package (DIP)
  - Plastic DIP (PDIP)
    - To keep the cost low
    - Plastic does not protect an IC from higher humidity conditions as does Ceramic packages
  - Ceramic DIP (CDIP)
    - Military designs would use ceramic packages
  - It is rectangular in shape and has leads extending from both sides along its length, thus forming two sets of in-line pins.



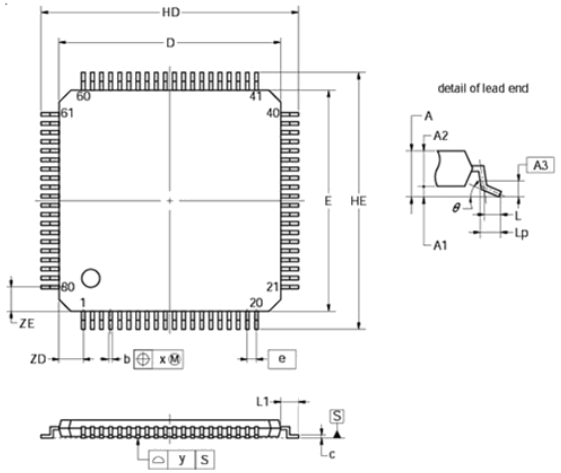
Packages

- Small outline integrated circuit (SOIC)
  - Occupies an area about 30–50% less than an equivalent dual in-line package (DIP)
  - Typical thickness being 70% less
  - Generally available in the same pin-outs as their counterpart DIP Ics
  - The convention for naming the package is SOIC or SO followed by the number of pins
    - For example, 14-pin 4011 would be housed in an SOIC-14 or SO-14 package



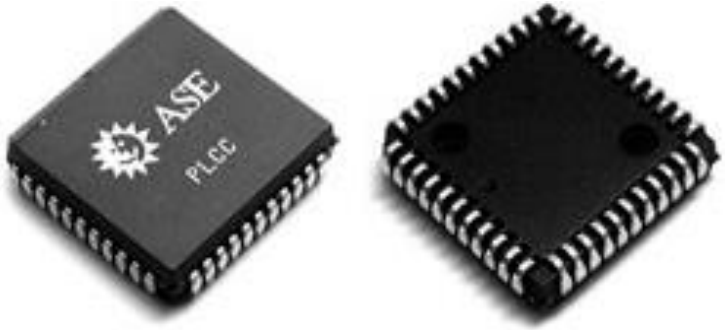
Packages

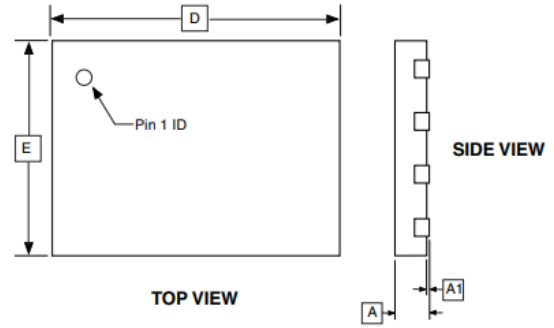
- Quad flat package (QFP)
  - Metric quad flat package (MQFP)
  - Low-profile QFP (LQFP)
  - Thin QFP (TQFP)
  - consists of a rectangular package a few millimetres thick. The package may be square with the same number of pins emanating from each edge or rectangular with different numbers of pins on each pair of sides
  - solve issues such as increasing board density
    - high numbers of interconnections

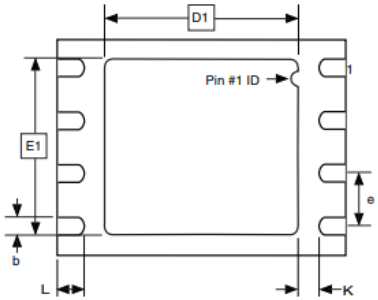


Packages

- Micro lead frame (MLF)





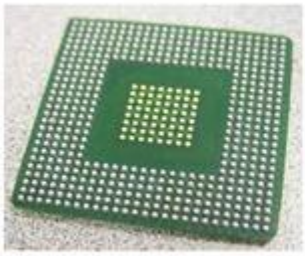


COMMON DIMENSIONS
(Unit of Measure = mm)

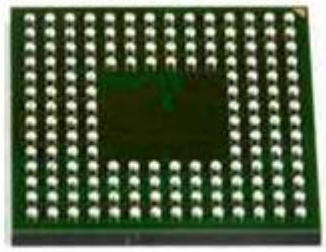
SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	1.00	
A1	–	–	0.05	
b	0.35	0.40	0.48	
D	7.90	8.00	8.10	
D1	6.30	6.40	6.50	
E	5.90	6.00	6.10	
E1	4.70	4.80	4.90	
e		1.27		
L	0.45	0.50	0.55	
K		0.30 REF		

Packages

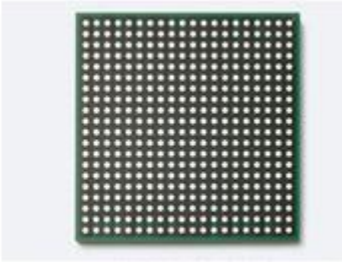
- Ceramic ball grid array (CBGA)
  - Can provide more interconnection pins than can be put on a dual in-line or flat package.
  - The whole bottom surface of the device can be used, instead of just the perimeter.



Staggered Type BGA



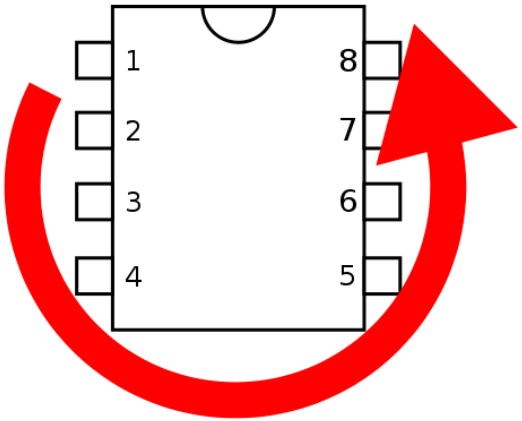
Peripheral Type BGA

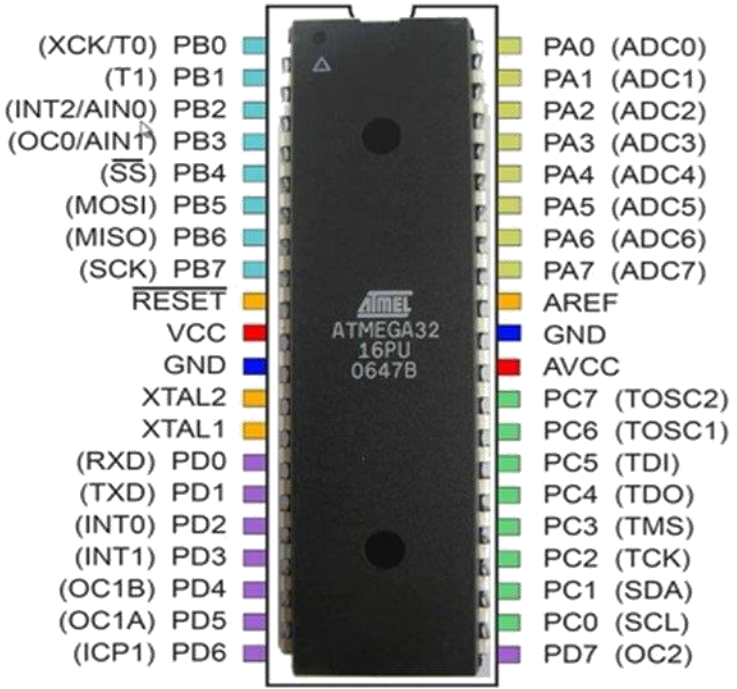


Full Array Type BGA

شماره‌گذاری پایه‌ها

- The AVR chip have a little notch at one end to designate the "top".
- The pin numbering starts at 1 on the top left, progress sequentially down the left side, and then back up the right side as shown in the schematic above.





پایان

موفق و پیروز باشید