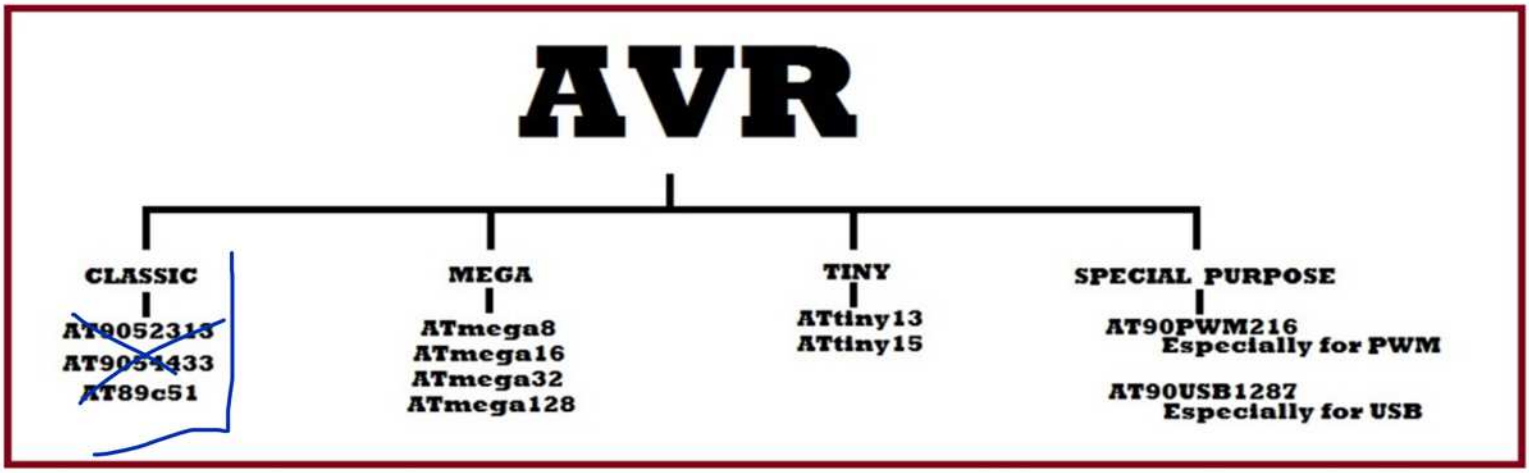
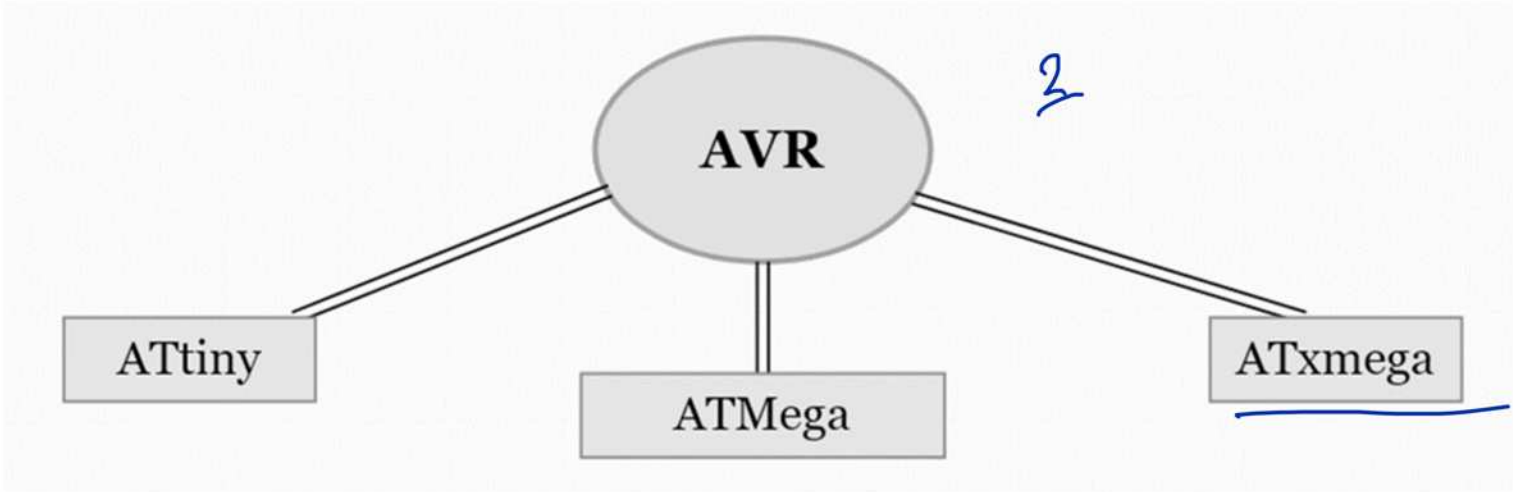
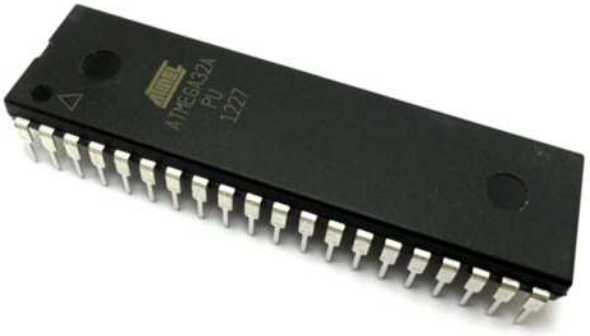
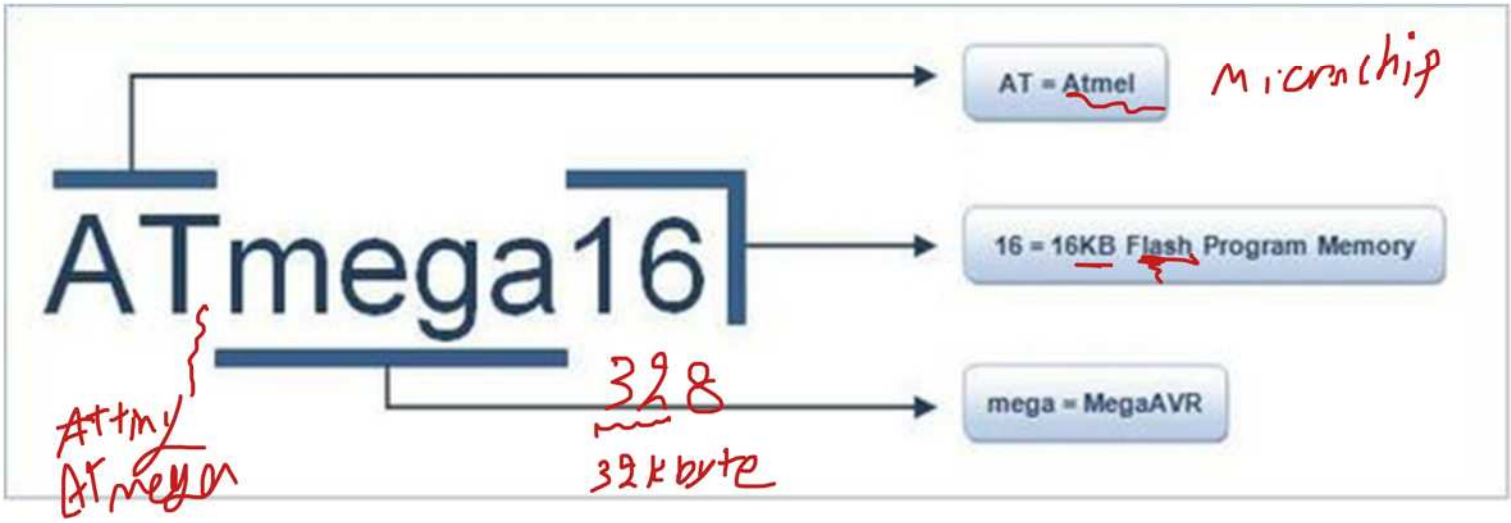




Series	Package size	FlashSize	Operating Frequency	Example
ATtiny(TinyAVR)	8-32 pins	0.5kB – 32kB	1.6MHz-32Mhz	ATtiny85
ATMega(megaAVR)	28-100 pins	4kB – 256kB	1.6MHz-32Mhz	ATMega328
ATxmegaXMEGA	44-100pins	16kB – 256kB	1.6MHz-32Mhz	ATXmega128

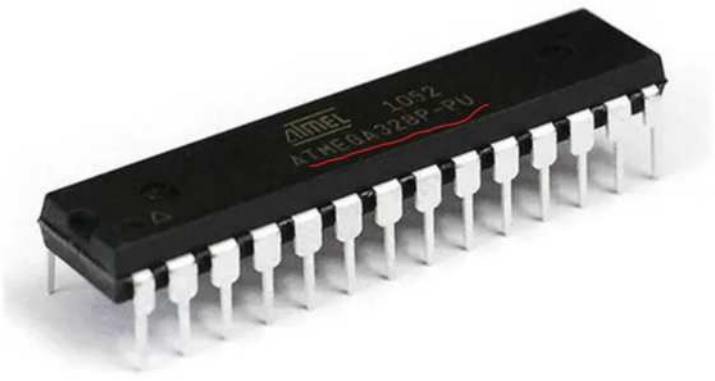


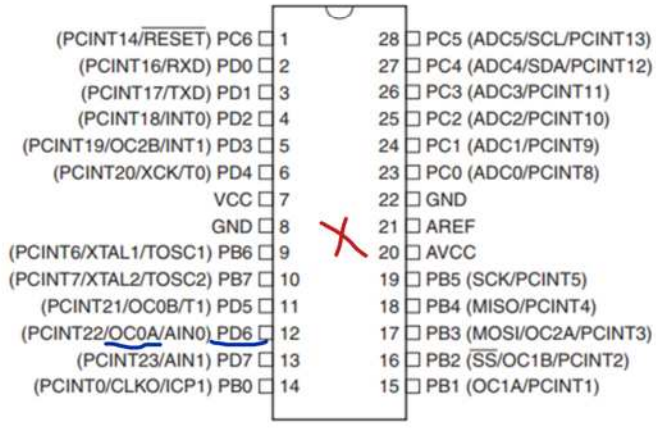
- **tinyAVR** – the ATtiny series
  - 0.5–16 kB program memory
  - 6–32-pin package
  - Limited peripheral set
- **megaAVR** – the ATmega series
  - 4–512 kB program memory
  - 28–100-pin package
  - Extended instruction set (multiply instructions and instructions for handling larger program memories)
  - Extensive peripheral set
- **XMEGA** – the ATxmega series
  - 16–384 kB program memory
  - 44–64–100-pin package (A4, A3, A1)
  - Extended performance features, such as DMA, "Event System", and cryptography support.
  - Extensive peripheral set with ADCs
- **Application-specific AVR**
  - megaAVRs with special features not found on the other members of the AVR family, such as LCD controller, USB controller, advanced PWM, CAN, etc.



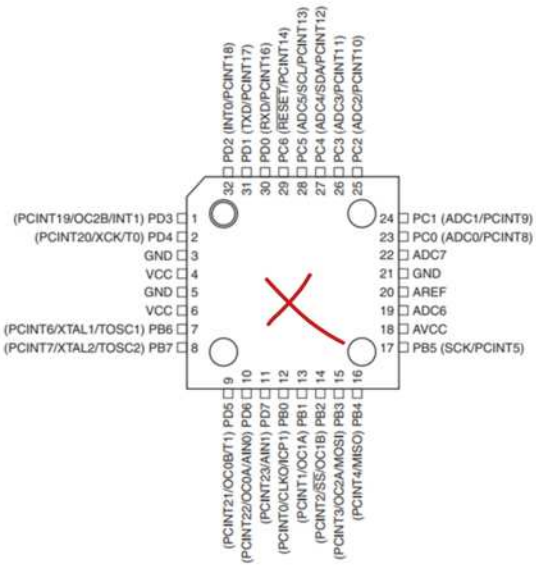
Features

- High Performance, Low Power AVR® 8-Bit Microcontroller Family
- Advanced RISC Architecture
  - 131 Powerful Instructions – Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 20 MIPS Throughput at 20MHz
  - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory Segments
  - 4/8/16/32KBytes of In-System Self-Programmable Flash program memory
  - 256/512/512/1KBytes EEPROM
  - 512/1K/1K/2KBytes Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/100 years at 25°C[1]
  - Optional Boot Code Section with Independent Lock Bits
    - In-System Programming by On-chip Boot Program
    - True Read-While-Write Operation
  - Programming Lock for Software Security
- QTouch® library support
  - Capacitive touch buttons, sliders and wheels
  - QTouch and QMatrix™ acquisition
  - Up to 64 sense channels
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
  - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode





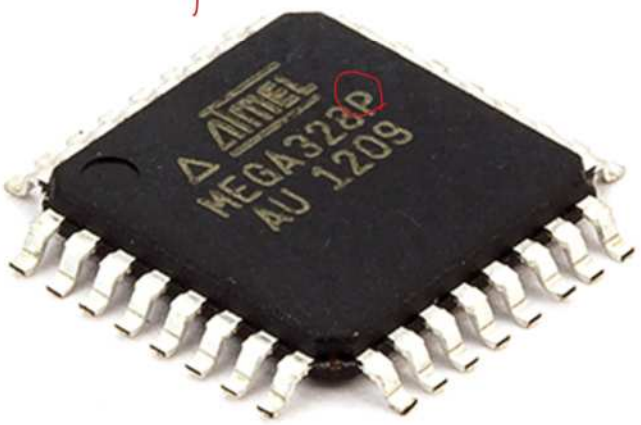
- Real Time Counter with Separate Oscillator
- Six PWM Channels
- 8-channel 10-bit ADC in TQFP and VQFN package
  - Temperature Measurement
- 6-channel 10-bit ADC in SPDIP Package
  - Temperature Measurement
- Programmable Serial USART
- Master/Slave SPI Serial Interface
- Byte-oriented 2-wire Serial Interface (Philips I²C compatible)
- Programmable Watchdog Timer with Separate On-chip Oscillator
- On-chip Analog Comparator
- Interrupt and Wake-up on Pin Change

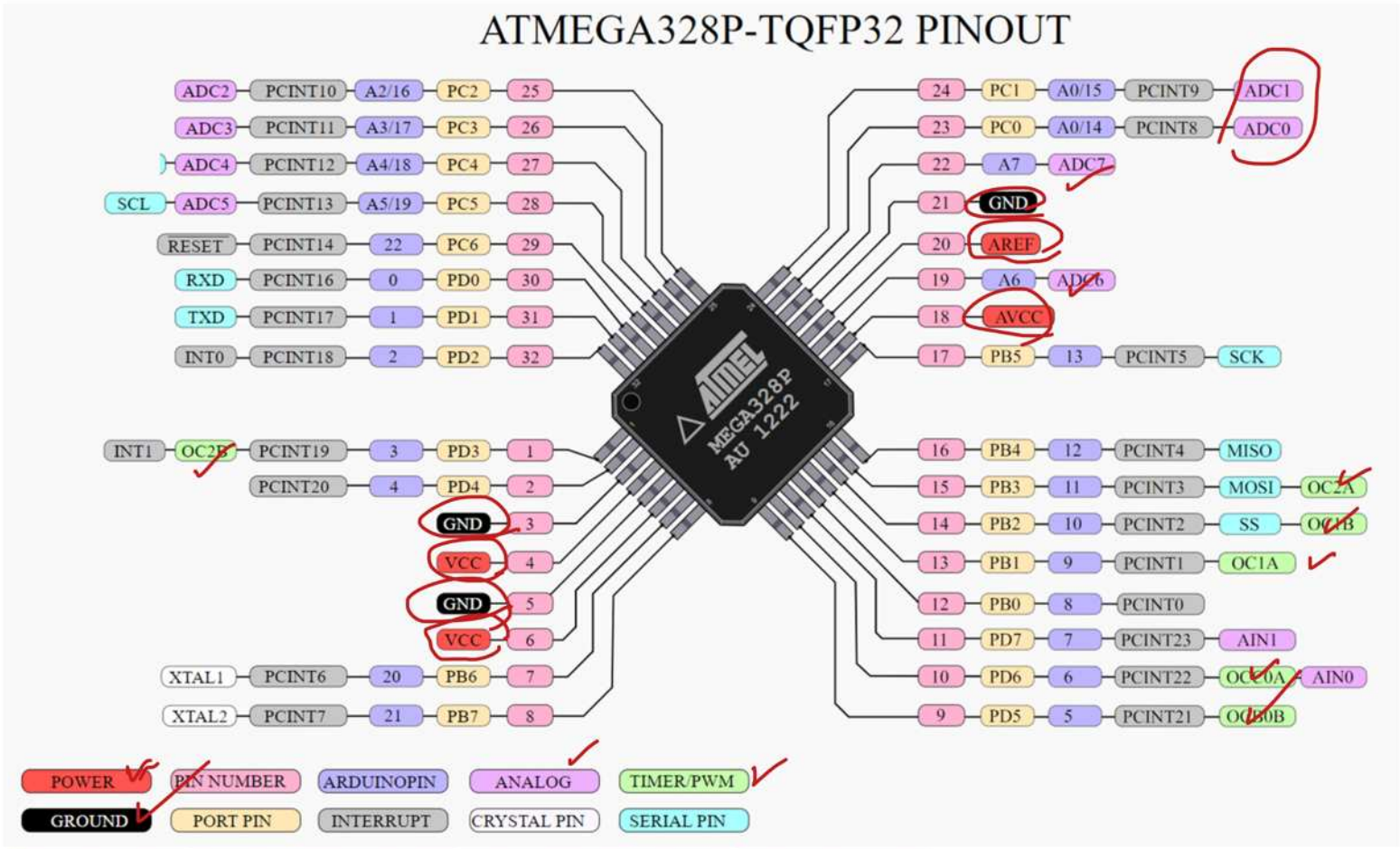


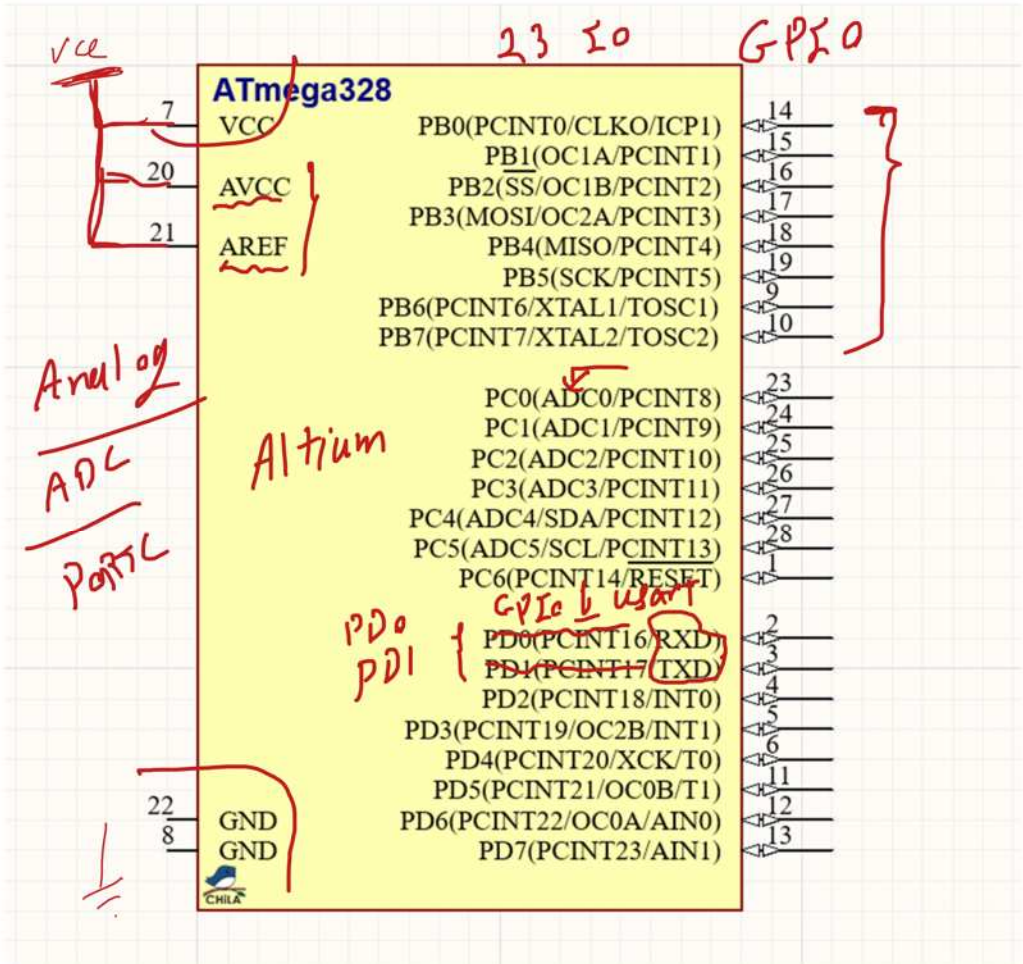
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby
- I/O and Packages
  - 23 Programmable I/O Lines
  - 28-pin SPDIP, 32-lead TQFP, 28-pad VQFN and 32-pad VQFN
- Operating Voltage:
  - 1.8 - 5.5V
- Temperature Range:
  - -40°C to 85°C
- Speed Grade:
  - 0 - 4MHz@1.8 - 5.5V, 0 - 10MHz@2.7 - 5.5.V, 0 - 20MHz @ 4.5 - 5.5V
- Power Consumption at 1MHz, 1.8V, 25°C
  - Active Mode: 0.2mA
  - Power-down Mode: 0.1µA
  - Power-save Mode: 0.75µA (Including 32kHz RTC)

0 ~ 8meg ATmega 328 4.5 ~ 5.5V
0 ~ 8M ATmega328h 2.5 ~ 5.5V
0 ~ 16M ATmega328A 2.5 ~ 5.5V
0 ~ 4M ATmega328h 1.8 ~ 5.5V

pico power





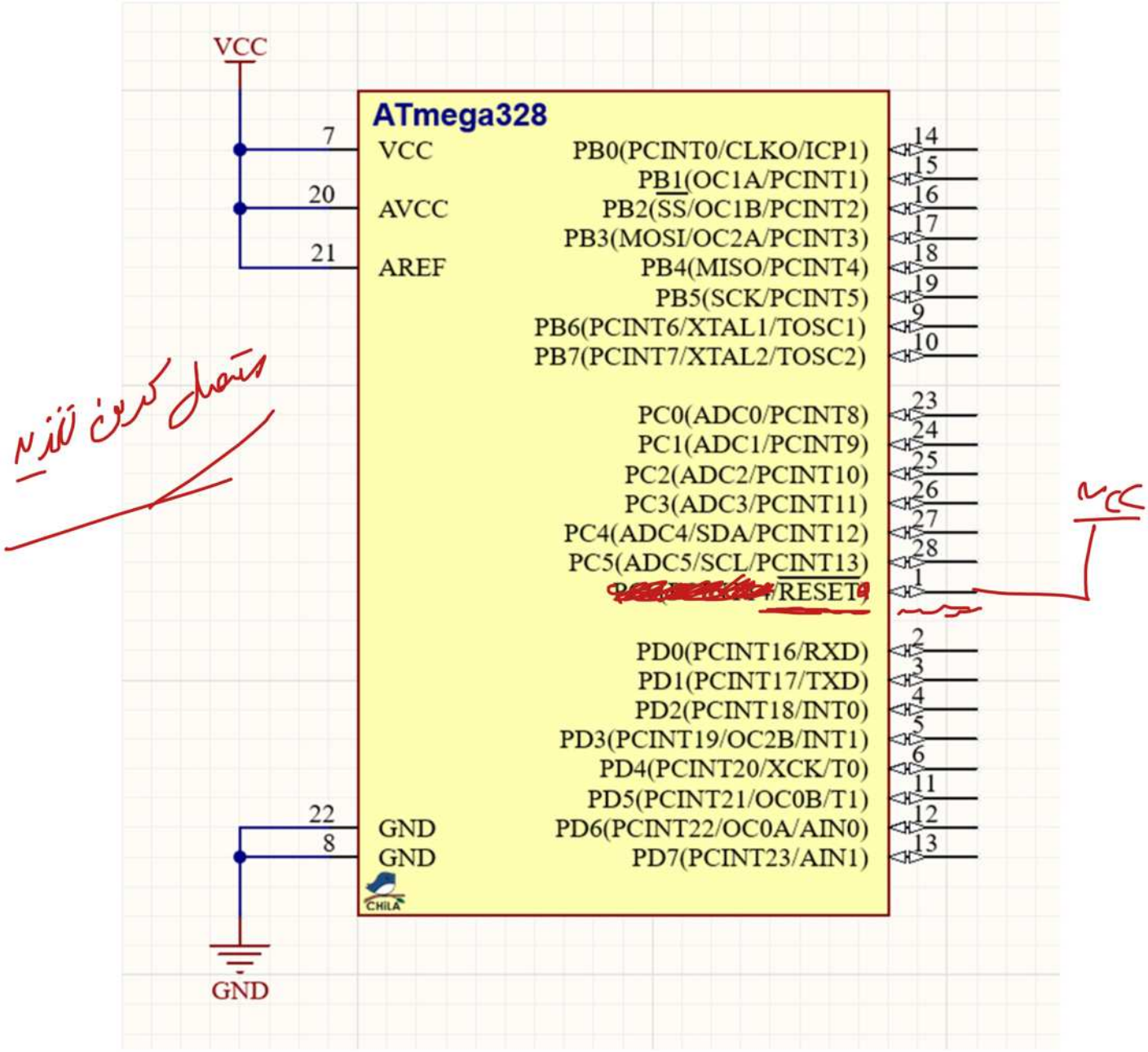


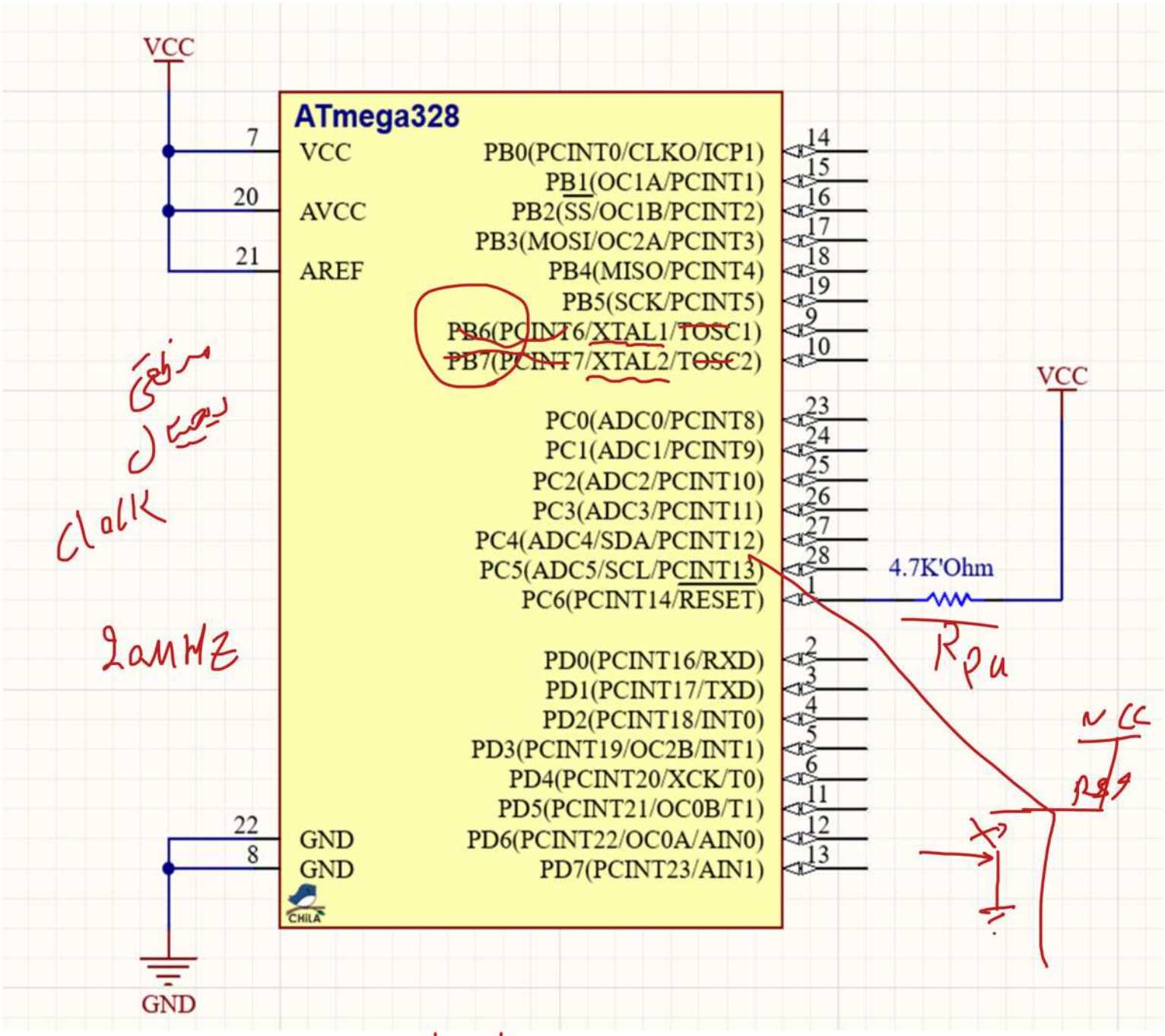
حداقل سخت افزار

Port ← 8 Pin
0 --- 7

PORT B
PORT C
PORT D

ATmega 32 4 PORT
A B C D


VCC
ATmega328
7
VCC
20
AVCC
21
AREF
22
GND
8
GND
GND
PB0(PCINT0/CLKO/ICP1)
PB1(OC1A/PCINT1)
PB2(SS/OC1B/PCINT2)
PB3(MOSI/OC2A/PCINT3)
PB4(MISO/PCINT4)
PB5(SCK/PCINT5)
PB6(PCINT6/XTAL1/TOSC1)
PB7(PCINT7/XTAL2/TOSC2)
PC0(ADC0/PCINT8)
PC1(ADC1/PCINT9)
PC2(ADC2/PCINT10)
PC3(ADC3/PCINT11)
PC4(ADC4/SDA/PCINT12)
PC5(ADC5/SCL/PCINT13)
/RESET
PD0(PCINT16/RXD)
PD1(PCINT17/TXD)
PD2(PCINT18/INT0)
PD3(PCINT19/OC2B/INT1)
PD4(PCINT20/XCK/T0)
PD5(PCINT21/OC0B/T1)
PD6(PCINT22/OC0A/AIN0)
PD7(PCINT23/AIN1)
14
15
16
17
18
19
9
10
23
24
25
26
27
28
1
2
3
4
5
6
11
12
13
CHILA

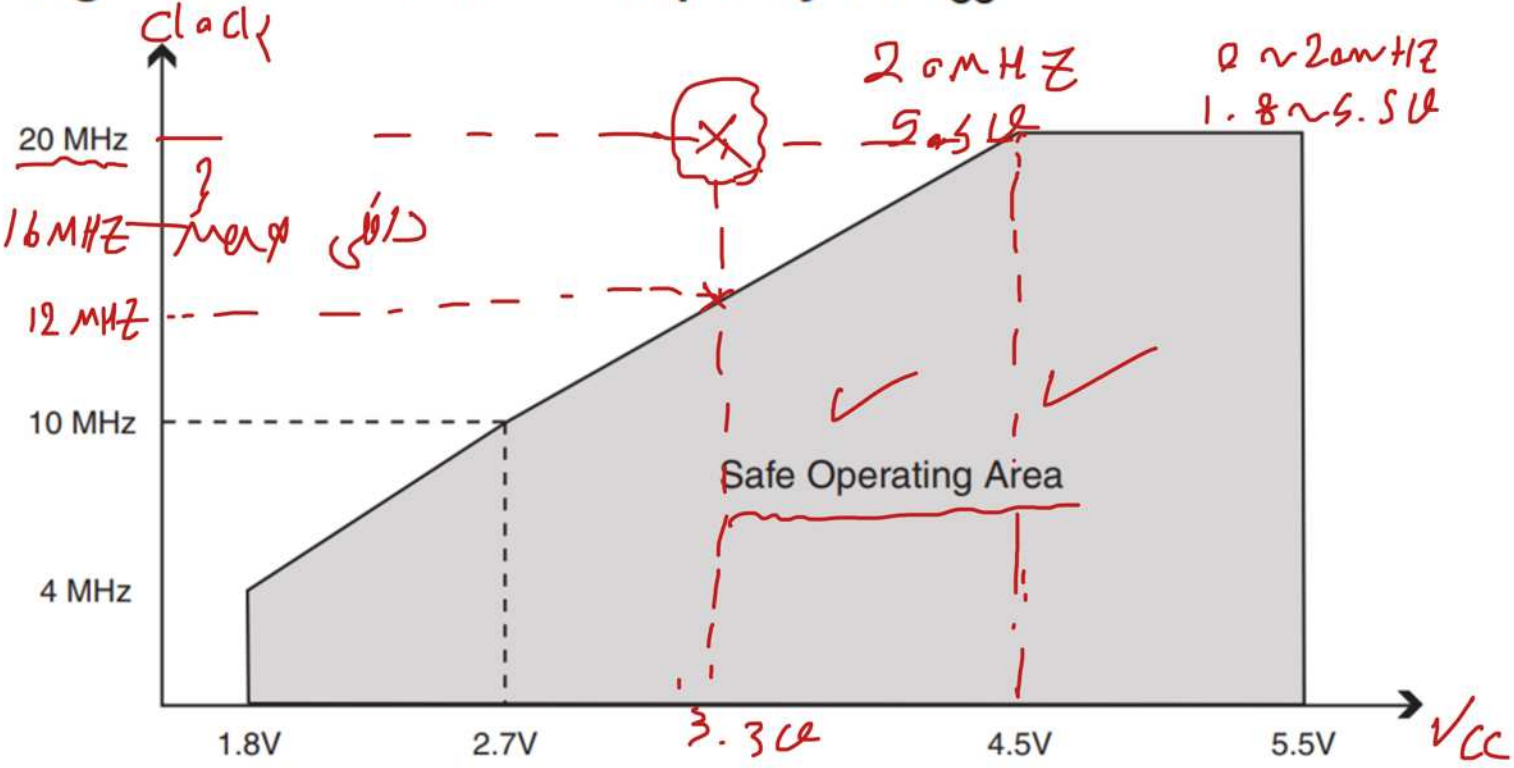


Clock داخلی

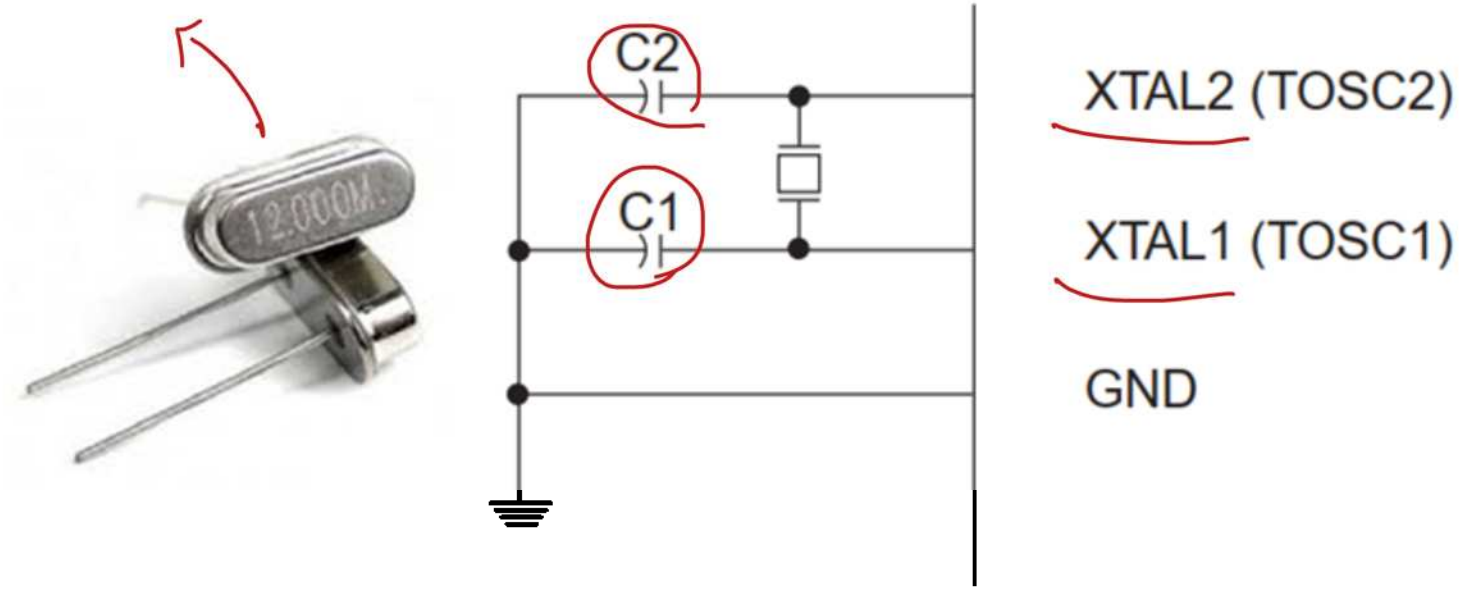
1MHZ

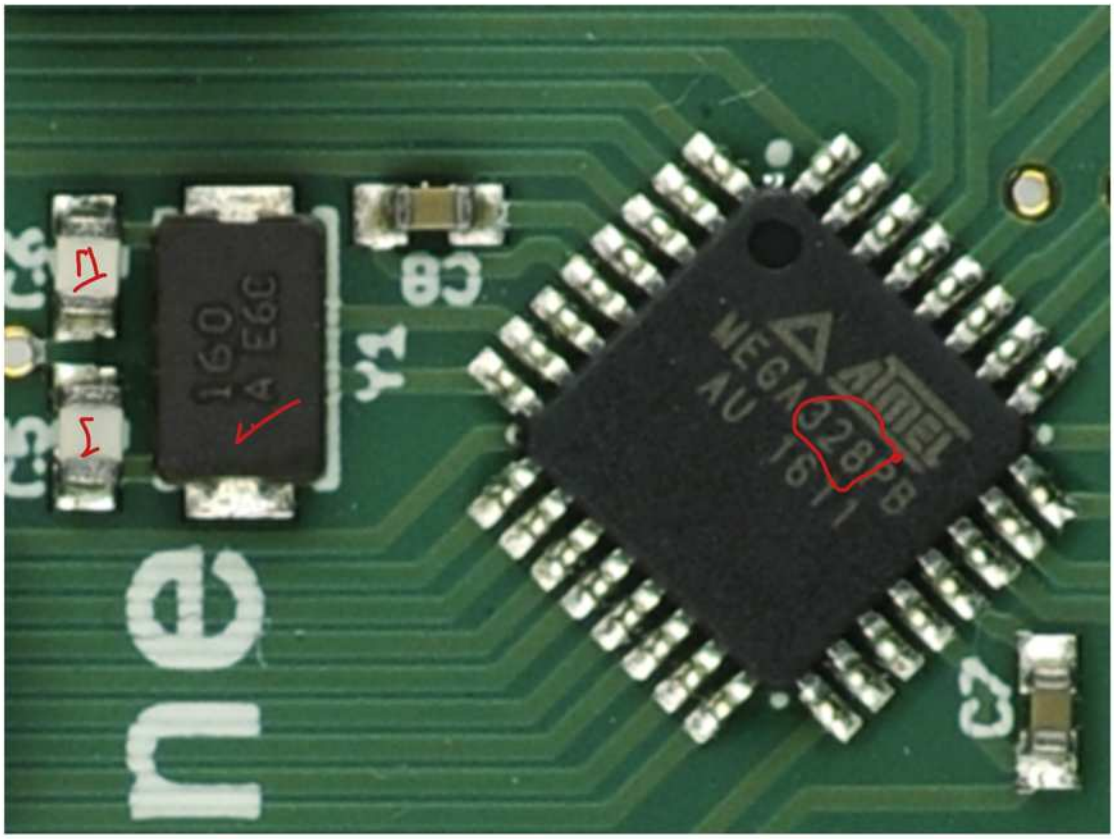
1/8

Figure 29-1. Maximum Frequency vs. V_{CC}

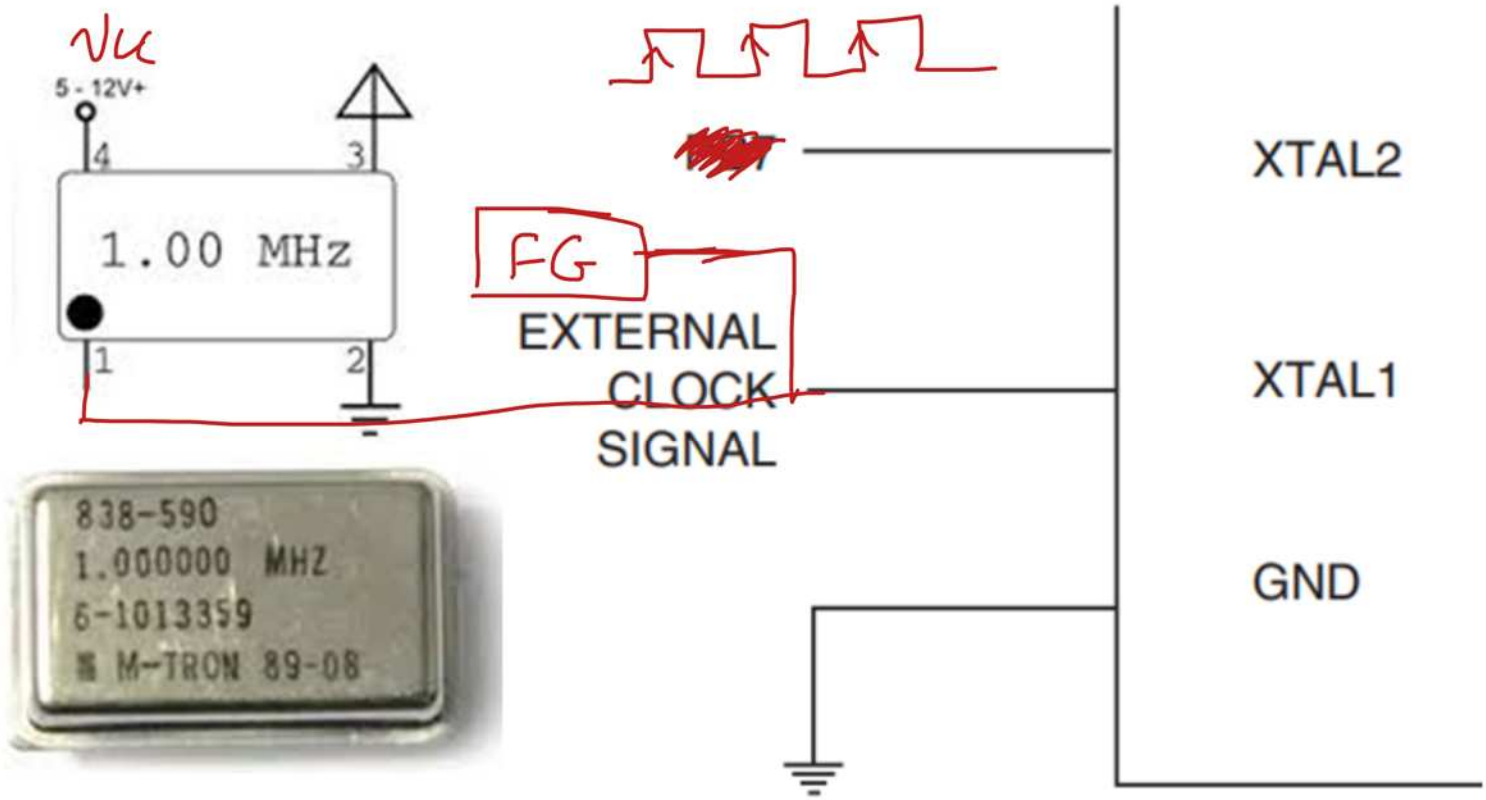


Crystal Oscillator Connections





External Clock Drive Configuration



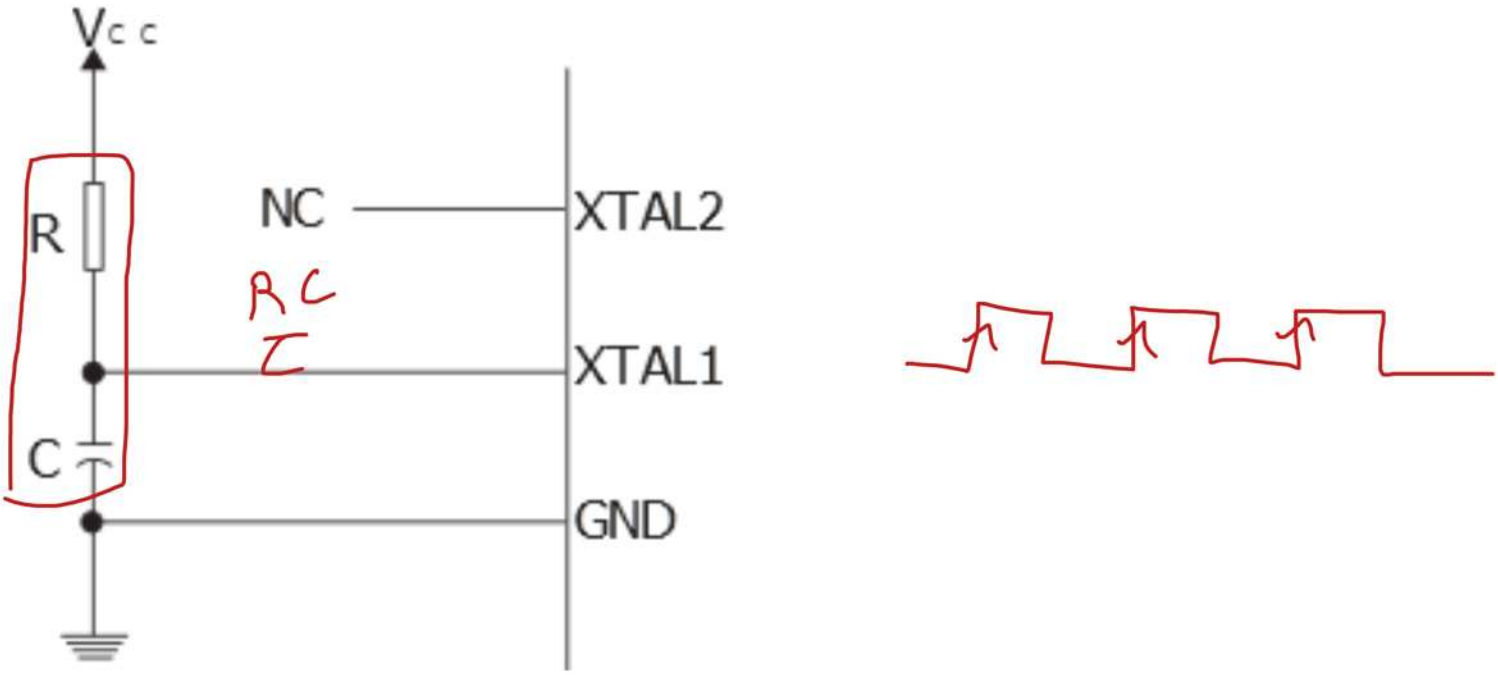


Figure 9-1. Clock Distribution