

# Beágyazott és érzékelő alapú rendszerek

2016 tavasz

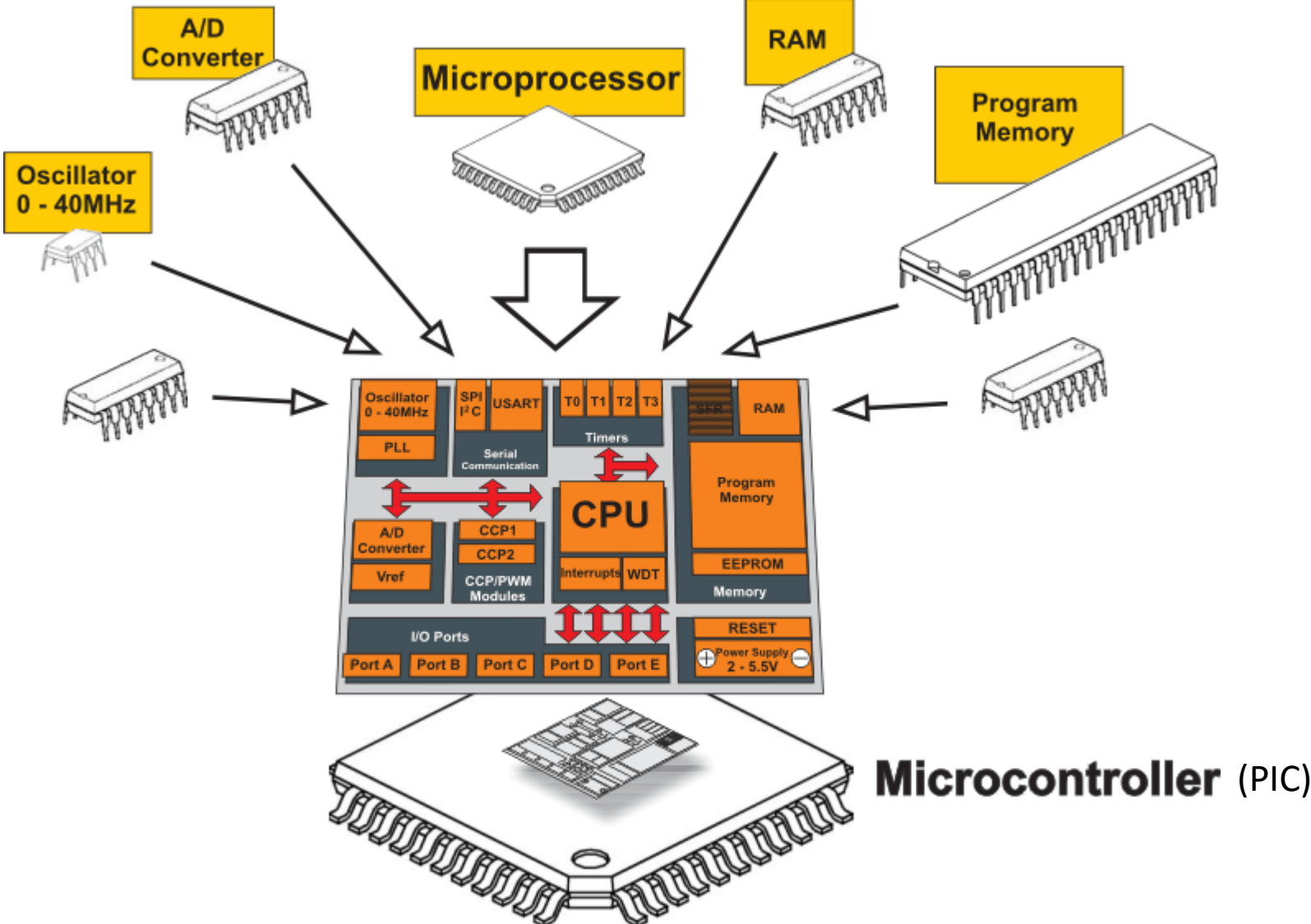
# Ütemezés

- Mikrokontrollerek általános ismertetése, ATMEL ATMEGA
- Programozás / debug üzemmód, féléves feladat témaválasztás,GPIO perifériák, ledék, gombok kezelése
- PWM jel
- Soros kommunikáció: USART, USB, (FTDI)
- ADC / DAC átalakítók, potméterek kezelése
- Időzítők
- Watchdog
- Megszakítások
- Szabályozási feladatok
- Féléves feladat leadás

# Számonkérés

- (Vizsga)
- Féléves feladat
  - Feladat kiírás
  - Munka: Arduino Mega
  - Dokumentáció (TDK?)
  - Prezentáció utolsó előtti héten
- *Szakdolgozat?*

# Mikrocontroller (μC, uC, MCU)



**Microcontroller (PIC)**



# Programozás

FIGURE 1-3: CONNECTING THE MPLAB® ICD 2 TO THE PICDEM™ MECHATRONICS DEMO BOARD

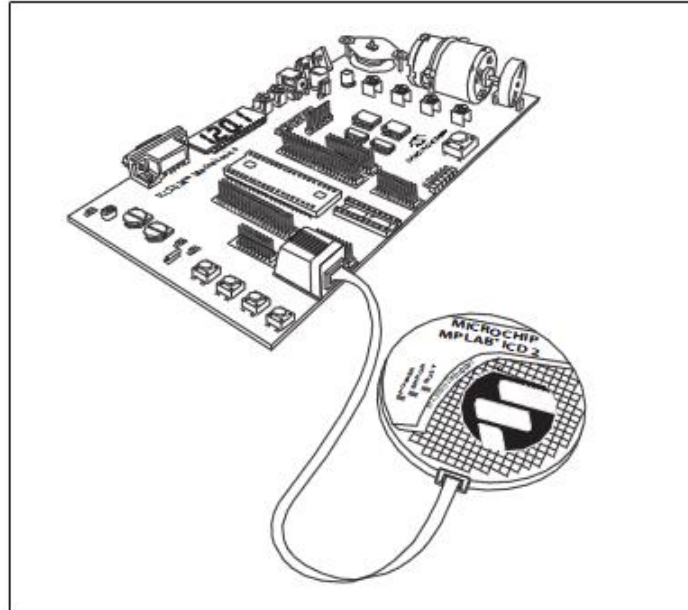
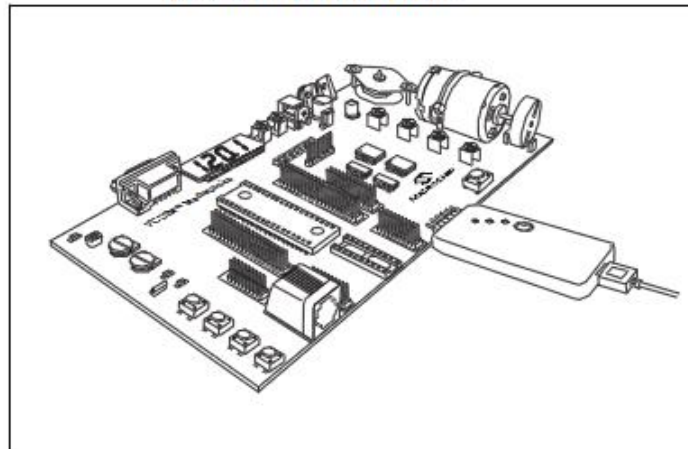
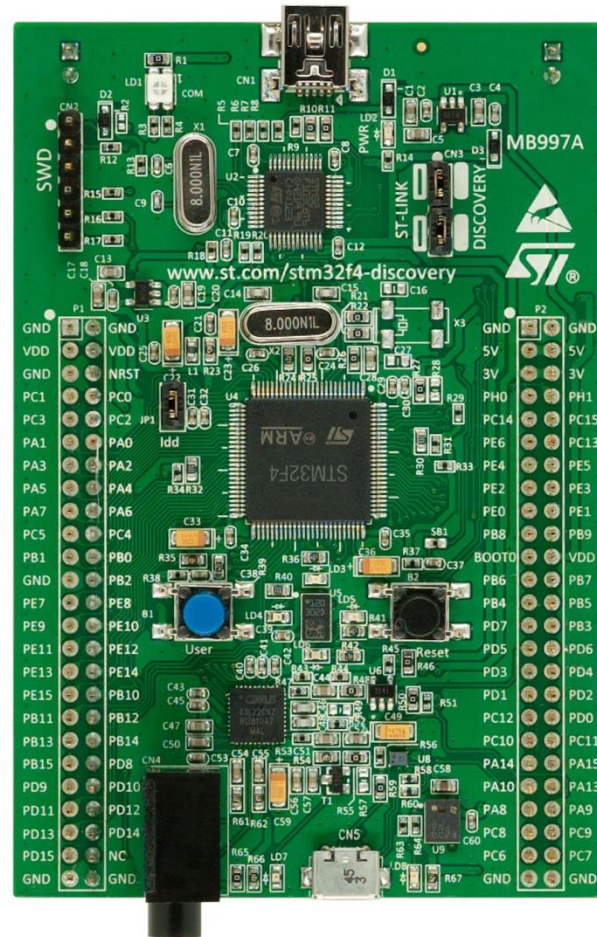


FIGURE 1-4: CONNECTING THE PICKIT™ 2 TO THE PICDEM™ MECHATRONICS DEMO BOARD



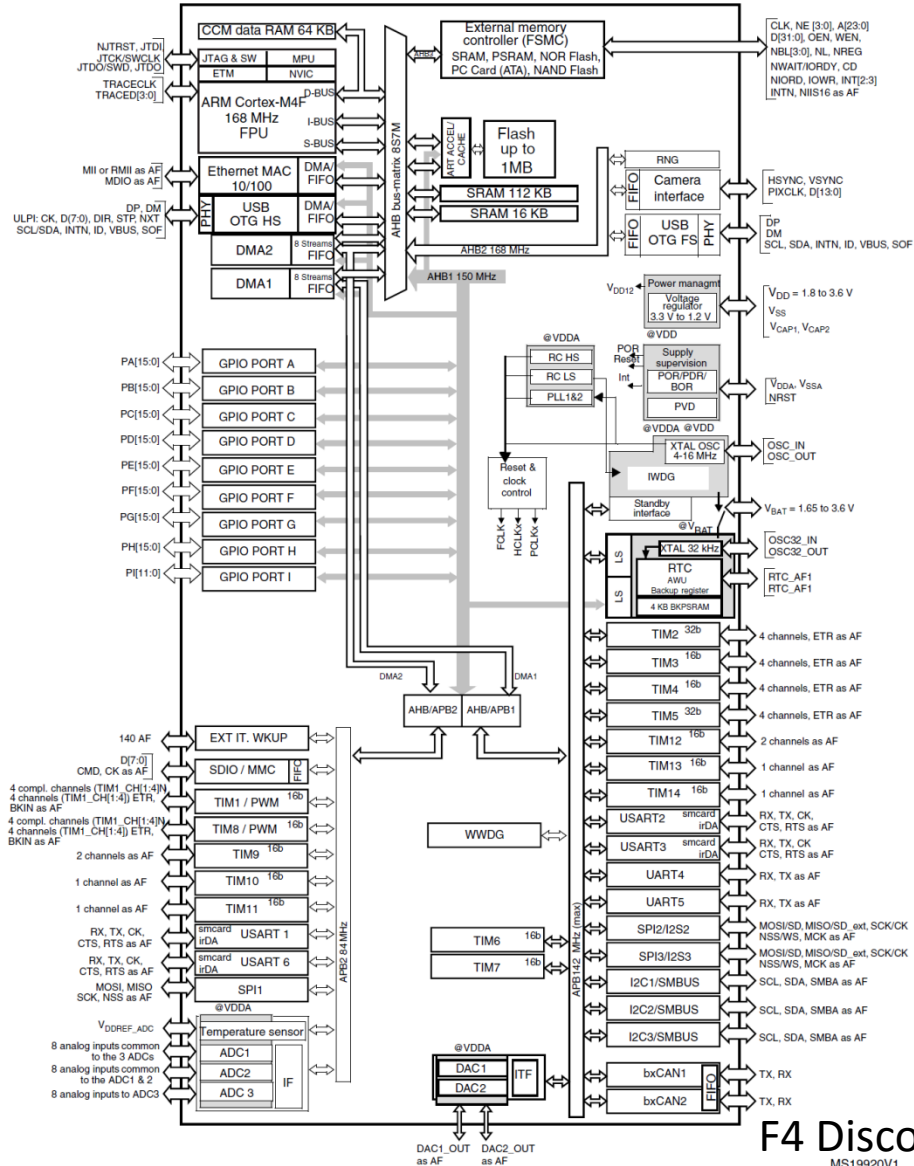
# STM32F4 Discovery







# STM32F4 Discovery



# PIC16/18 család

- 8 bites MCU (PIC16F917 – 20MHz)
- I/O:
  - 5 MIPS
  - 8 csatornás 10bites A/D
  - 1 USART
  - 1 I2C/SPI
  - 2 CCP (capture, compare, PWM)
  - 2x8bit, 1x16bit timer
  - stb

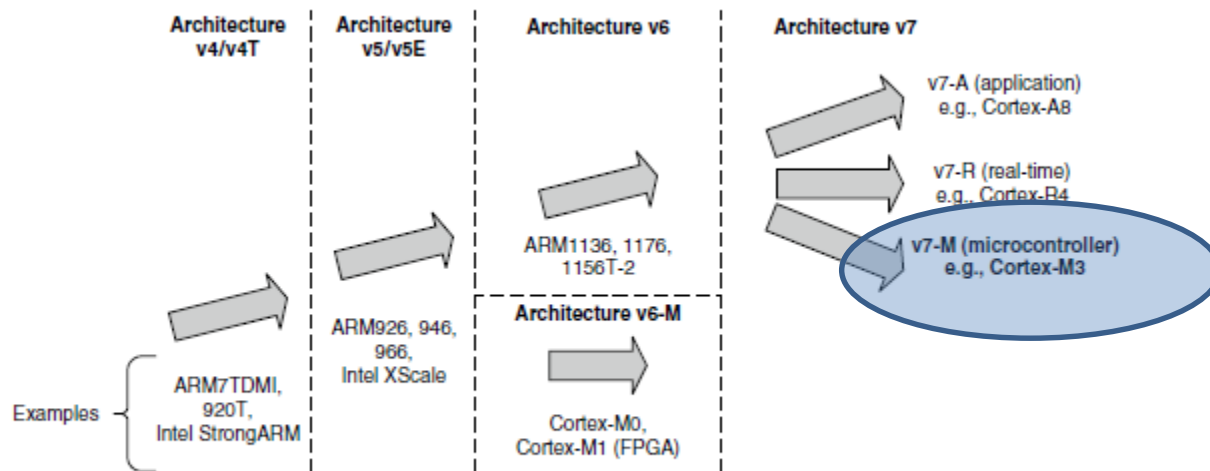
# STM32F4 család

- 32 bites MCU, (STM32F407 168MHz + FPU)
- I/O:
  - 1 MB Flash/192+4 KBRAM,
  - USB OTG HS/FS,
  - Ethernet,
  - 17 TIM,
  - 3×12-bit ADC,
  - 2×12-bit DAC,
  - DMA
  - LCD parallel interface, 8080/6800 modes
  - ....

ARM  
STM32F4

# ARM evolúció

A8, A9: 600MHz+,  
1..4 mag, jellemzően  
mobil eszközök



**FIGURE 1.2**

The Evolution of ARM Processor Architecture.



# Lábkiosztás

Pin number						Pin name (function after reset) <sup>(1)</sup>	Pin type	I/O structure	Notes	Alternate functions	Additional functions
LQFP64	WLCSP90	LQFP100	LQFP144	UFBGA176	LQFP176						
14	C10	23	34	N3	40	PA0-WKUP (PA0)	I/O	FT	(5)	USART2_CTS/UART4_TX/ ETH_MII_CRS / TIM2_CH1_ETR/ TIM5_CH1 / TIM8_ETR/ EVENTOUT	ADC123_IN0/WKUP <sup>(4)</sup>
15	F8	24	35	N2	41	PA1	I/O	FT	(4)	USART2_RTS / UART4_RX/ ETH_RMII_REF_CLK / ETH_MII_RX_CLK / TIM5_CH2 / TIM2_CH2/ EVENTOUT	ADC123_IN1
16	J10	25	36	P2	42	PA2	I/O	FT	(4)	USART2_TX/TIM5_CH3 / TIM9_CH1 / TIM2_CH3 / ETH_MDIO/ EVENTOUT	ADC123_IN2
-	-	-	-	F4	43	PH2	I/O	FT		ETH_MII_CRS/EVENTOUT	
-	-	-	-	G4	44	PH3	I/O	FT		ETH_MII_COL/EVENTOUT	
-	-	-	-	H4	45	PH4	I/O	FT		I2C2_SCL / OTG_HS_ULPI_NXT/ EVENTOUT	

# Memória térkép

0xFFFFFFFF	System level	Private peripherals including build-in interrupt controller (NVIC), MPU control registers, and debug components
0xE0000000		
0xDFFFFFFF	External device	Mainly used as external peripherals
0xA0000000		
0x9FFFFFFF	External RAM	Mainly used as external memory
0x60000000		
0x5FFFFFFF		
0x40000000	Peripherals	Mainly used as peripherals
0x3FFFFFFF		
0x20000000	SRAM	Mainly used as static RAM
0x1FFFFFFF		
0x00000000	CODE	Mainly used for program code. Also provides exception vector table after power up



# ATMEL

- ATMEGA (ATmega2560) – 8bit
  - Pl. Arduino Mega

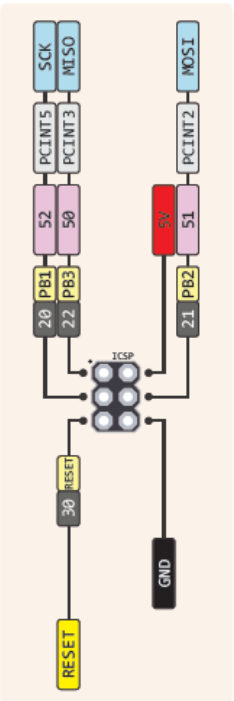


# ATMEL

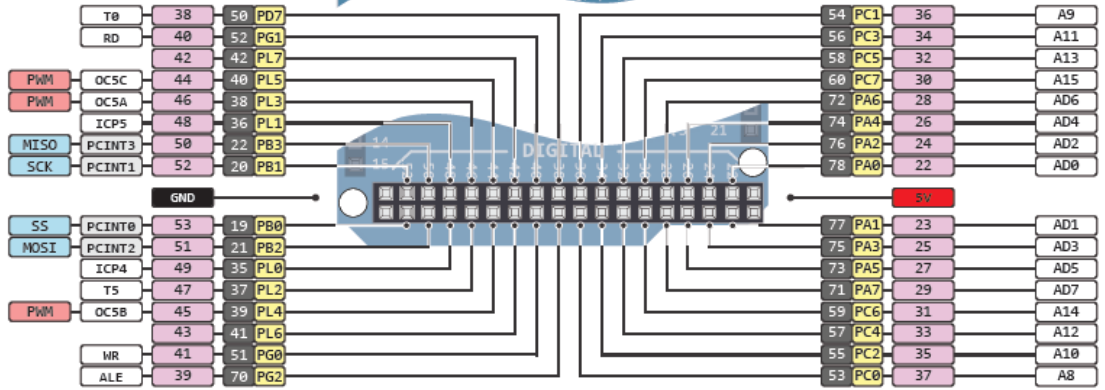
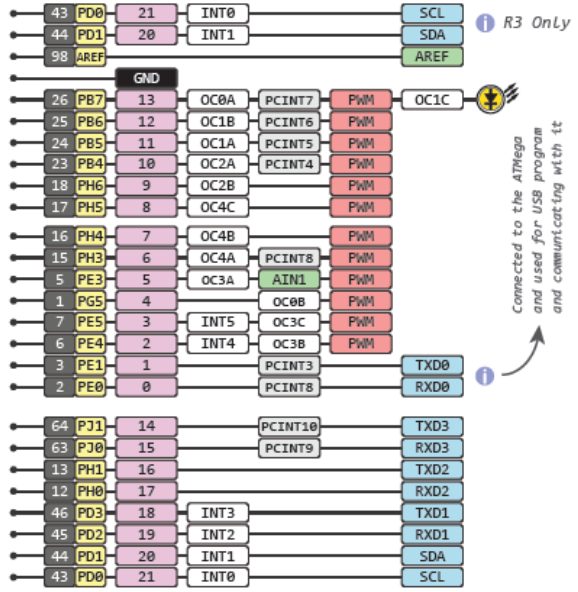
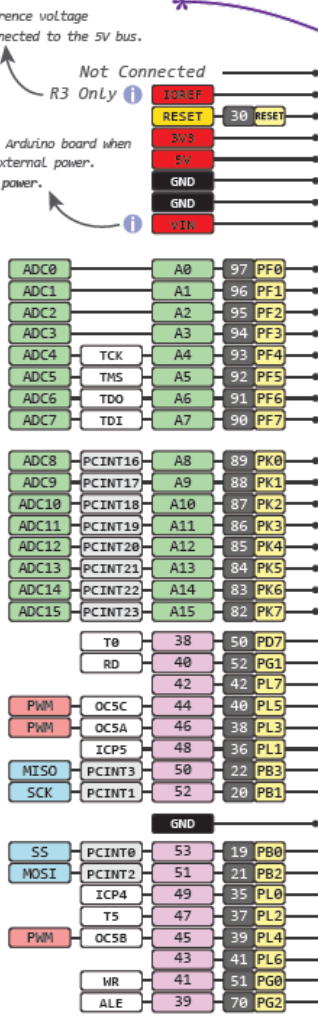
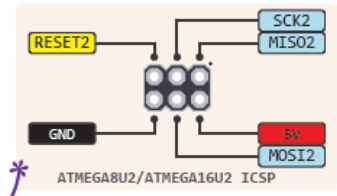
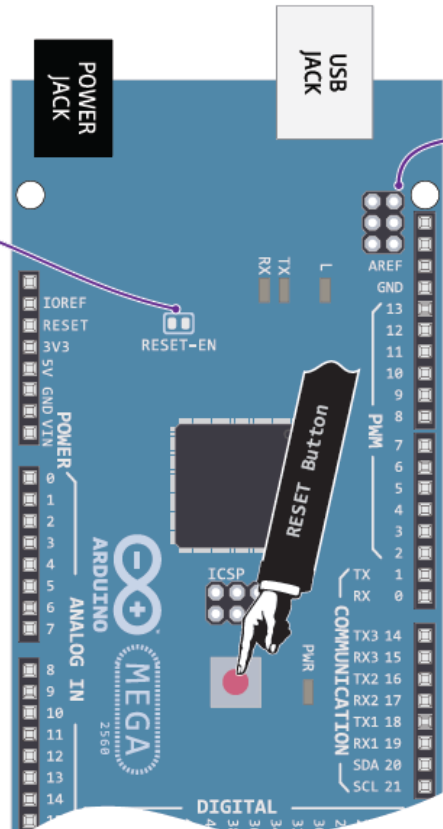
- ATMEGA (ATmega2560)

Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz

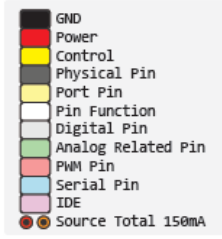
# ARDUINO MEGA PINOUT DIAGRAM



Cut to disable the auto-reset  
 This provides a Logic reference voltage for shields that use it. It is connected to the 5V bus.

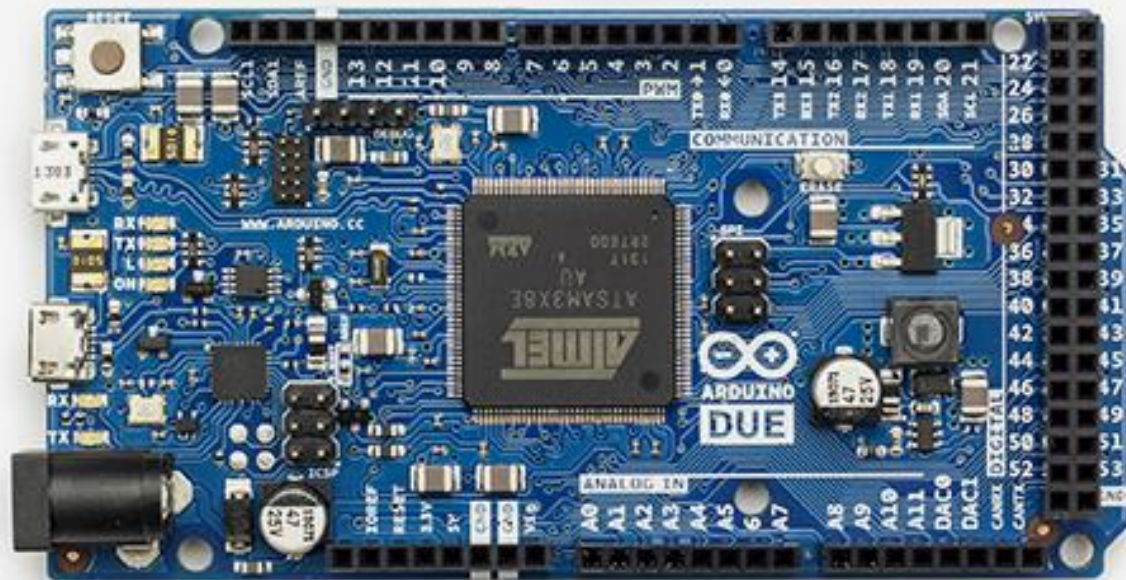


⚡ Absolute max per pin 40mA  
 recommended 20mA  
 ⚡ Absolute max 200mA  
 for entire package



# ATMEL

- Atmel SAM3X8E ARM Cortex-M3 CPU – 32bit  
– Arduino Due

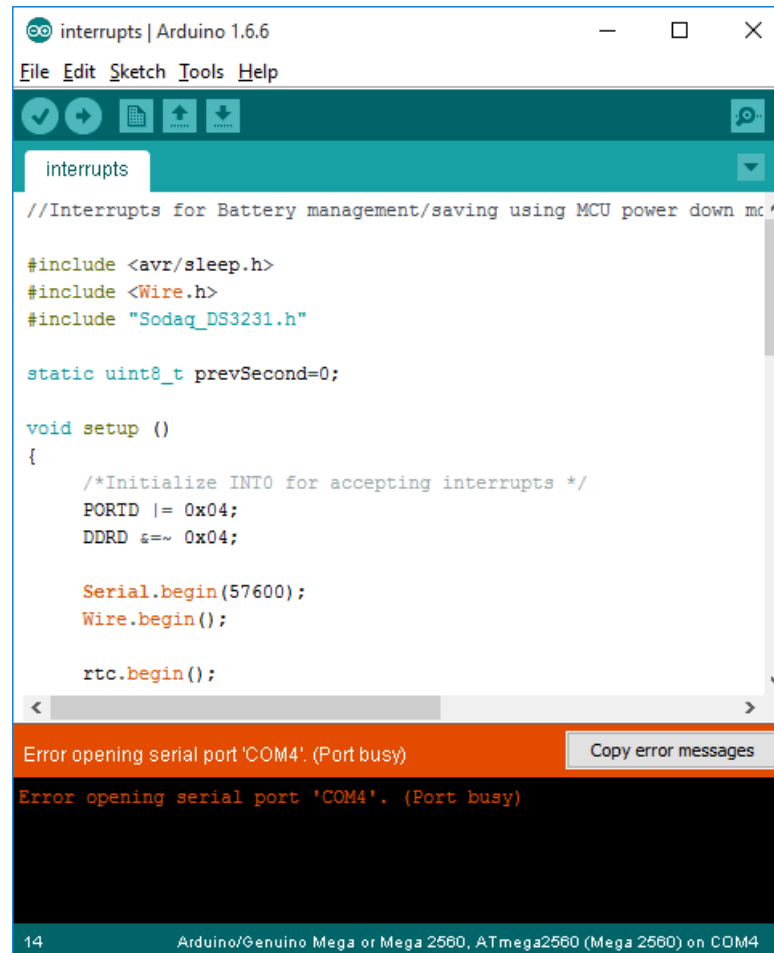


# ATMEL

Microcontroller	AT91SAM3X8E
Operating Voltage	3.3V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-16V
Digital I/O Pins	54 (of which 12 provide PWM output)
Analog Input Pins	12
Analog Output Pins	2 (DAC)
Total DC Output Current on all I/O lines	130 mA
Flash Memory	512 KB all available for the user applications
SRAM	96 KB (two banks: 64KB and 32KB)
Clock Speed	84 MHz

+ DMA, DAC, 32bit

# Arduino IDE



The screenshot shows the Arduino IDE window titled "interrupts | Arduino 1.6.6". The menu bar includes "File", "Edit", "Sketch", "Tools", and "Help". The toolbar contains icons for saving, running, uploading, and downloading. The sketch editor shows the following code:

```
//Interrupts for Battery management/saving using MCU power down mc^
#include <avr/sleep.h>
#include <Wire.h>
#include "Sodaq_DS3231.h"

static uint8_t prevSecond=0;

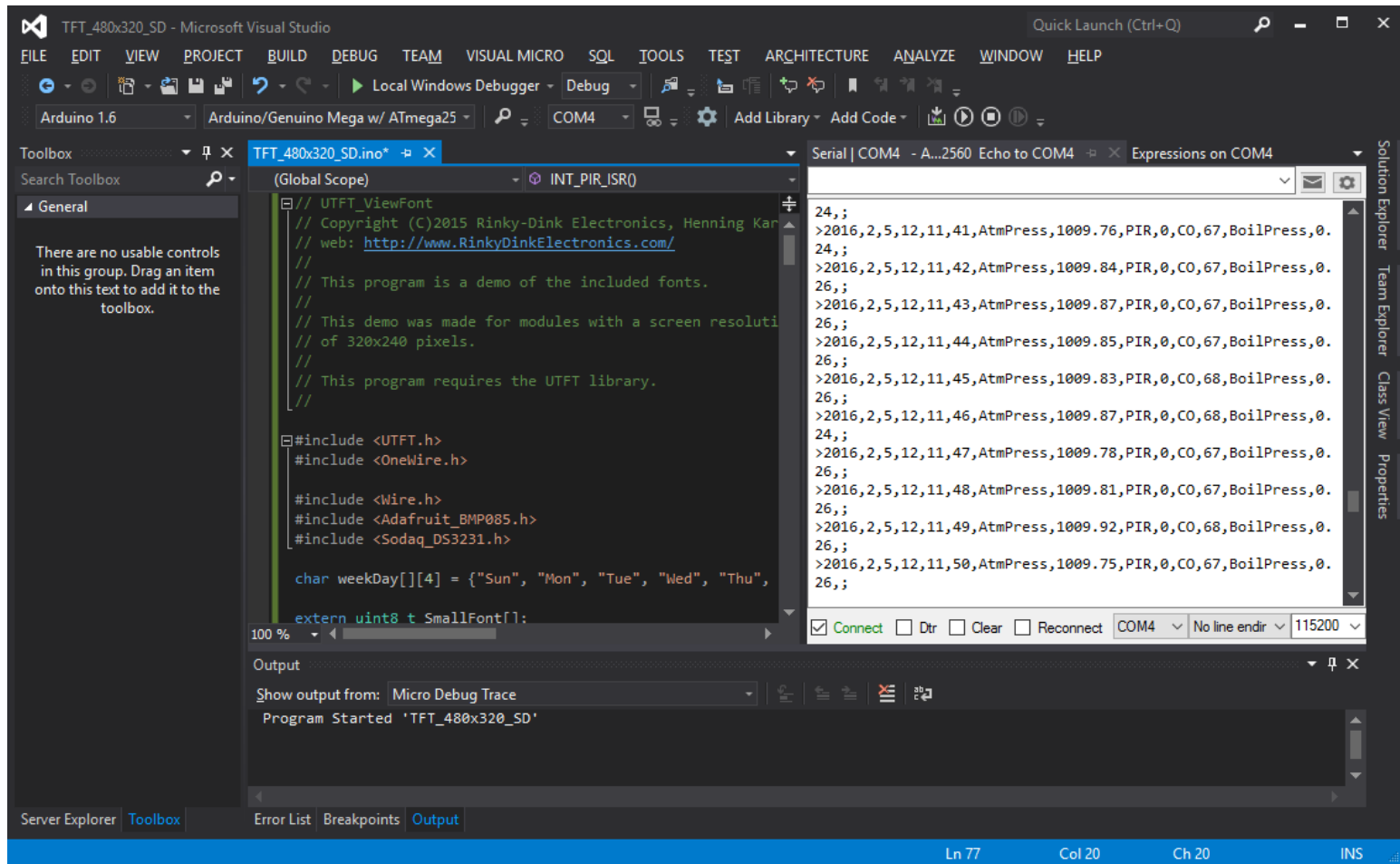
void setup ()
{
    /*Initialize INT0 for accepting interrupts */
    PORTD |= 0x04;
    DDRD &=~ 0x04;

    Serial.begin(57600);
    Wire.begin();

    rtc.begin();
}
```

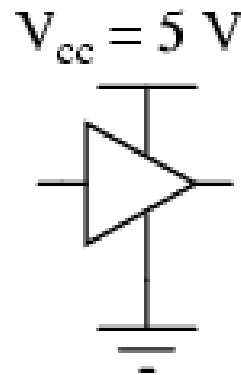
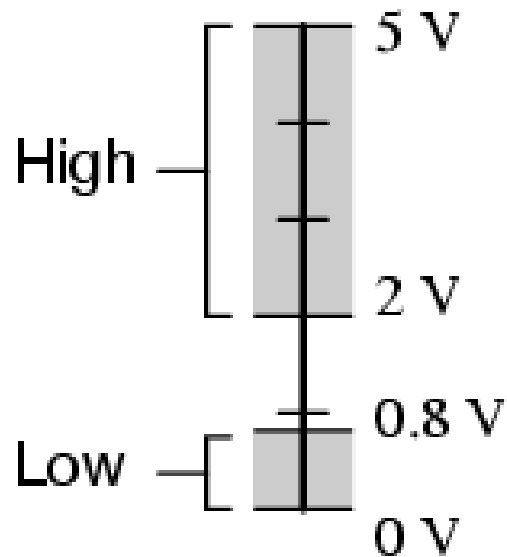
Below the code editor, an orange error message box displays: "Error opening serial port 'COM4'. (Port busy)". A "Copy error messages" button is located to the right of the error message. The status bar at the bottom indicates "14 Arduino/Genuino Mega or Mega 2560, ATmega2560 (Mega 2560) on COM4".

# VisualMicro (VS)

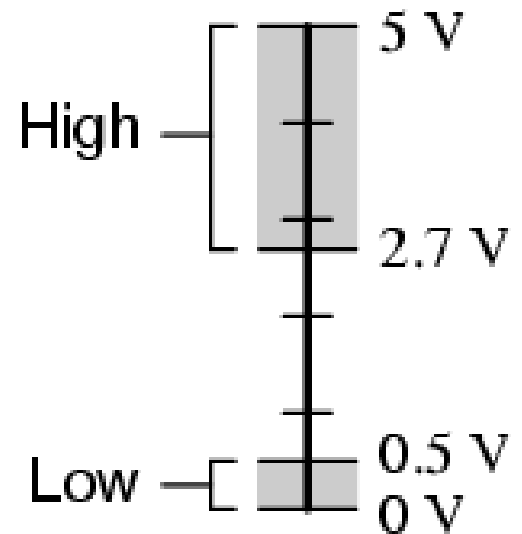


# Logikai jelszintek

*Acceptable TTL gate  
input signal levels*

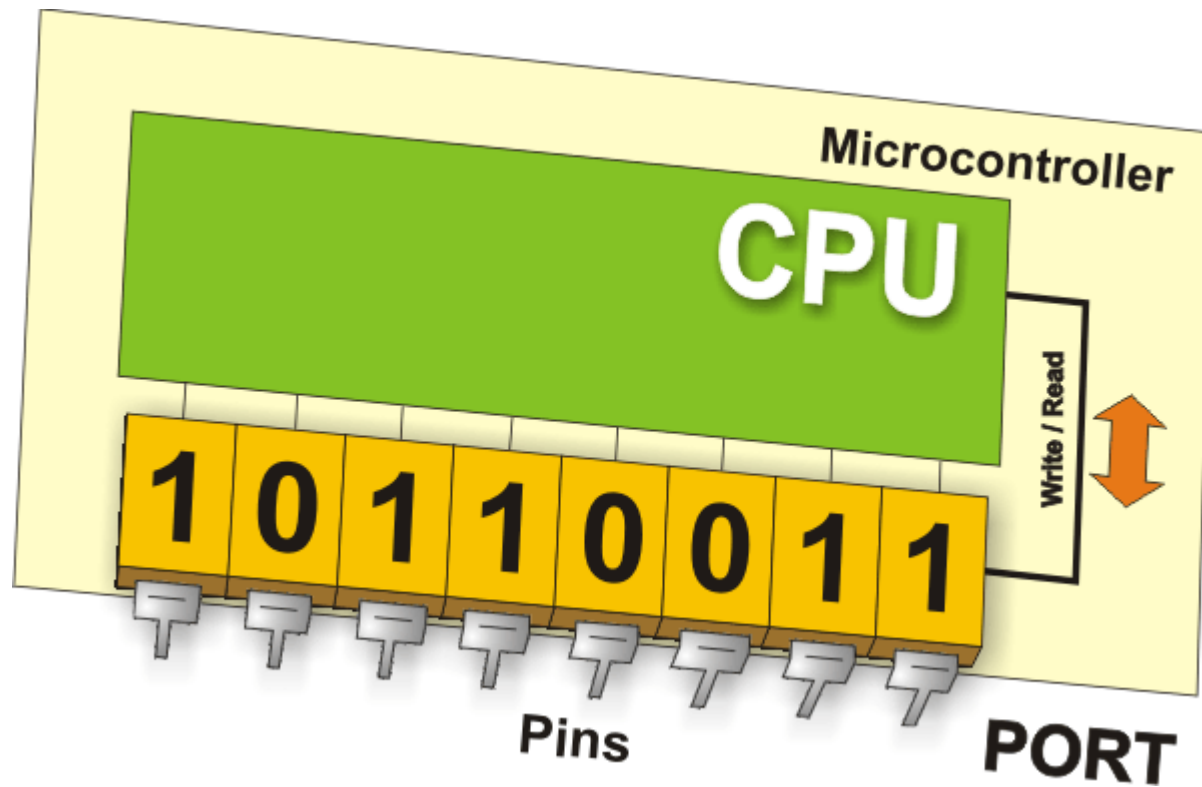


*Acceptable TTL gate  
output signal levels*





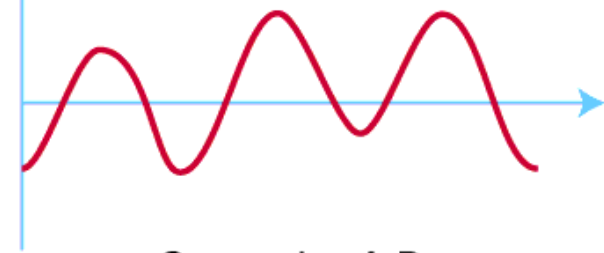
# Digitális I/O



# Analóg I/O: A/D D/A konverzió

- Pl. 10 biten 1024 érték

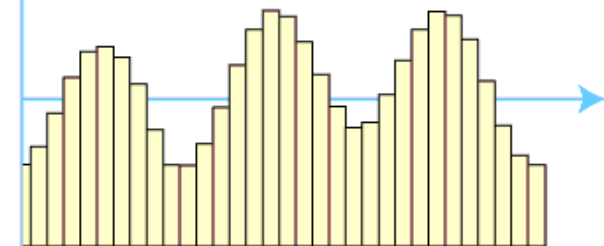
fig. 1



Conversion A-D



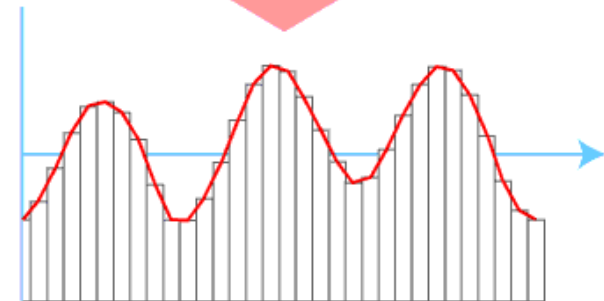
fig. 2



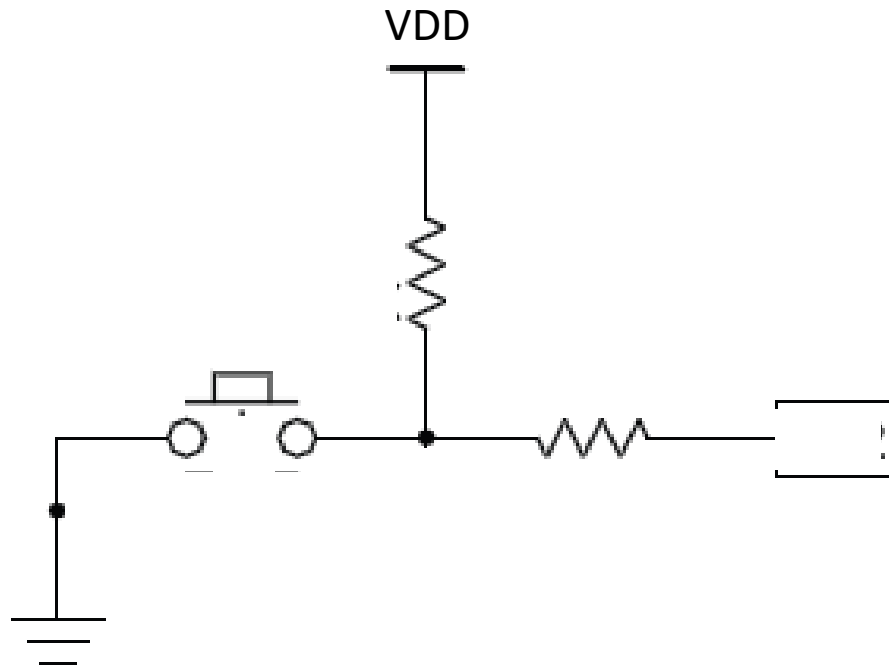
Conversion D-A



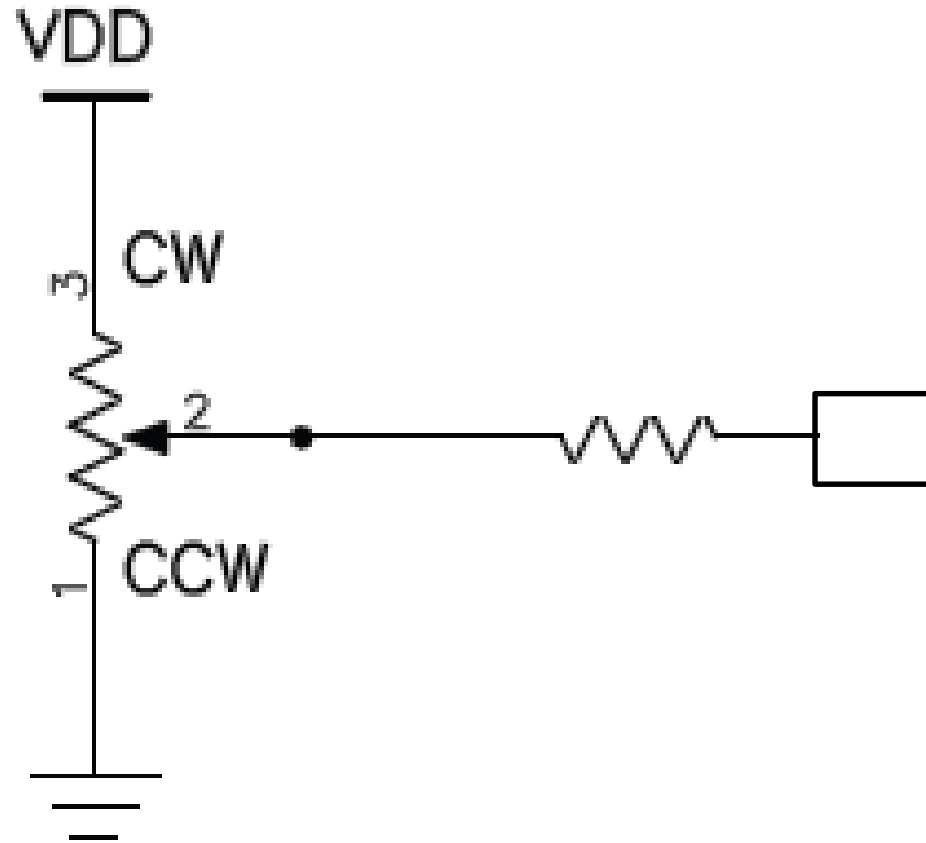
fig. 3



# Bilentyű

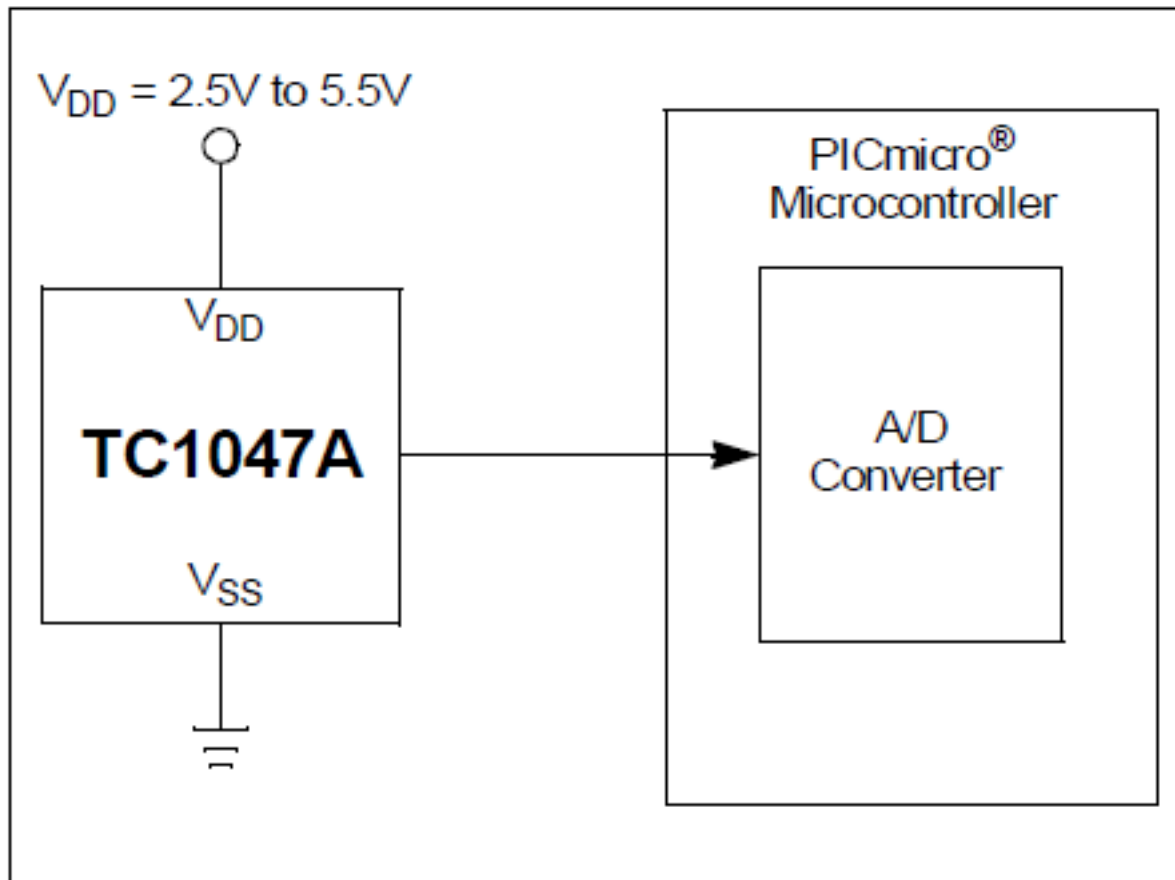


# Potmeter



# Hőszenzor

## Block Diagram



# Hőszenzor

FIGURE 3-1: OUTPUT VOLTAGE VS. TEMPERATURE

