

KICK-OFF ARDUINO CURSUS

UBA MWV

Deel 1

Arduino

AT mega328

UNO

Nano

Wat is Arduino?

- Volgens www.arduino.com:

“ Arduino is an open-source electronics prototyping platform based on easy-to-use hardware and software...”

- **Arduino** is een **break-out bordje** met Xtal, USB, power supply + een **microcontroller** AT Mega386 met een **bootloader** + een **IDE*** + **C#-programmeertaal** + **community**

(* Integrated development environment)

Arduino versus kale **AT MEGA386P**



- **Compleet**
- **IC bevat loadersoftw.**
- **USB aanwezig voor software-upload en communicatie**
- **Kost +/- 10-20 euro**



alleen het IC

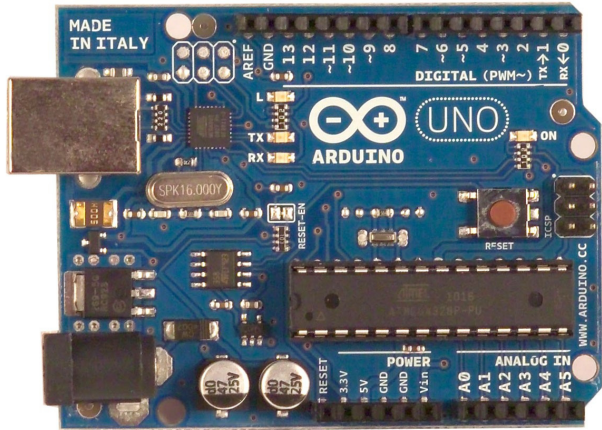
geen code aanwezig

programmer nodig(ISP)

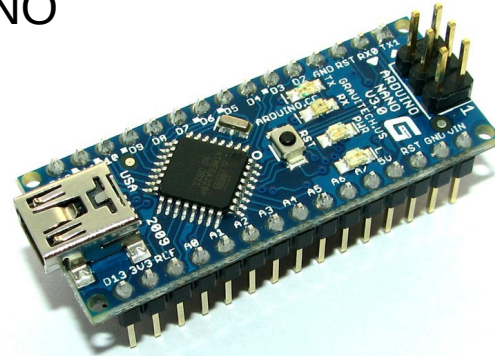
kost +/- 2,50 euro

Smaken van Arduino

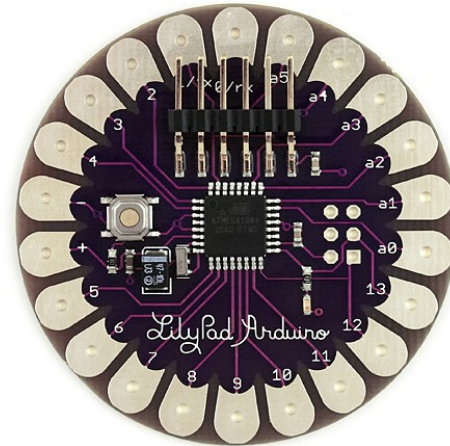
UNO



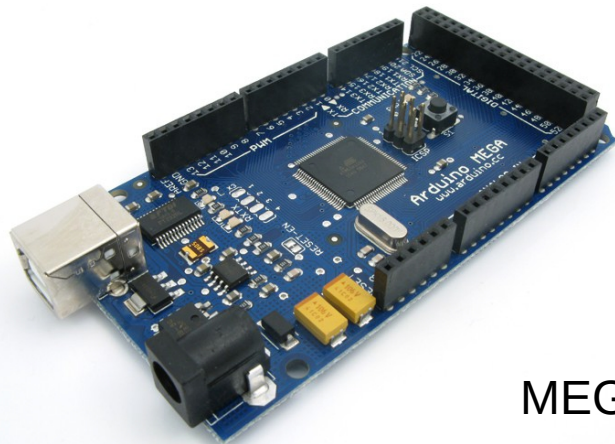
NANO



LILLY

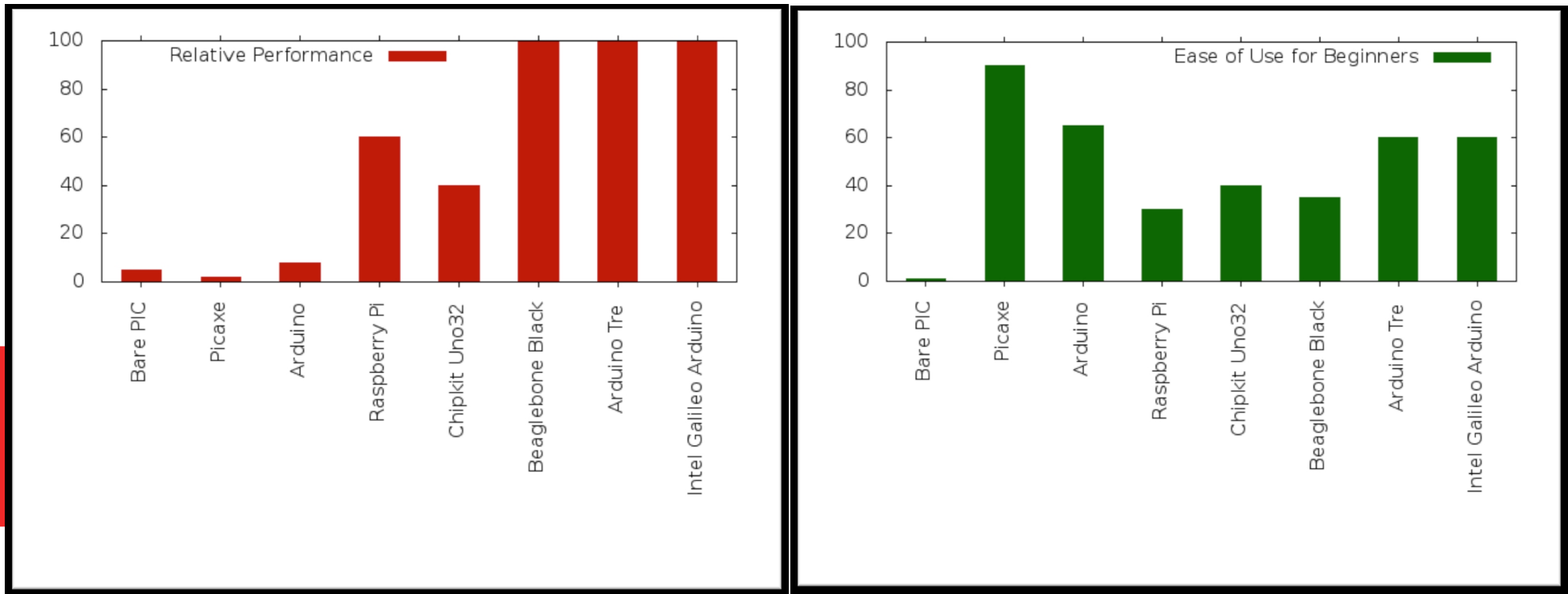


MEGA

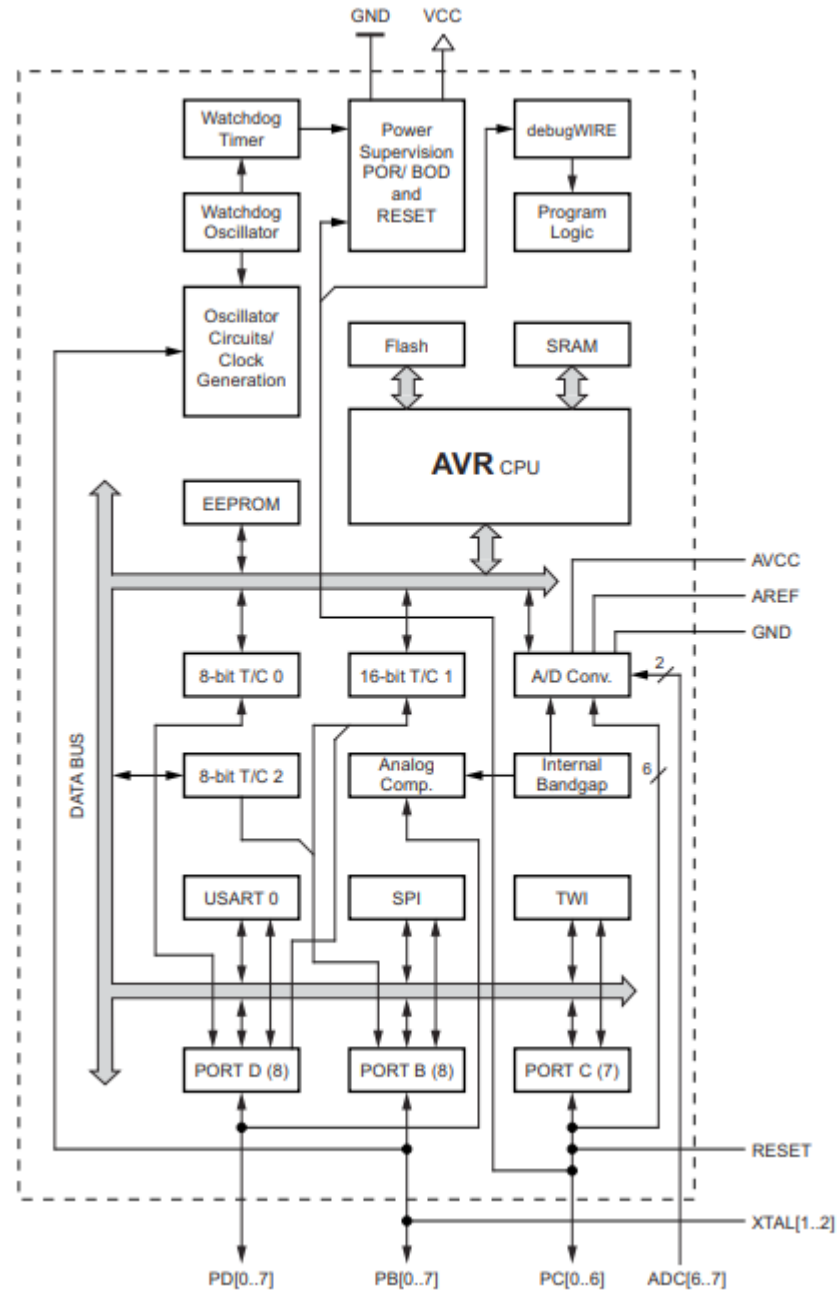
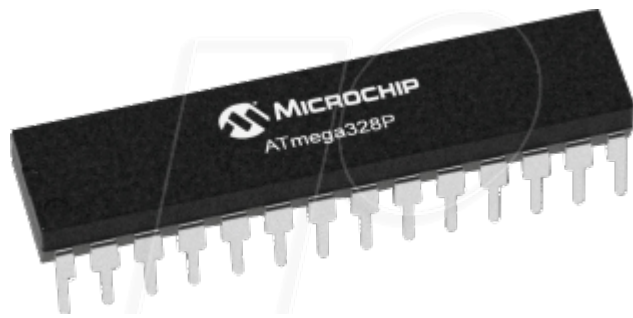


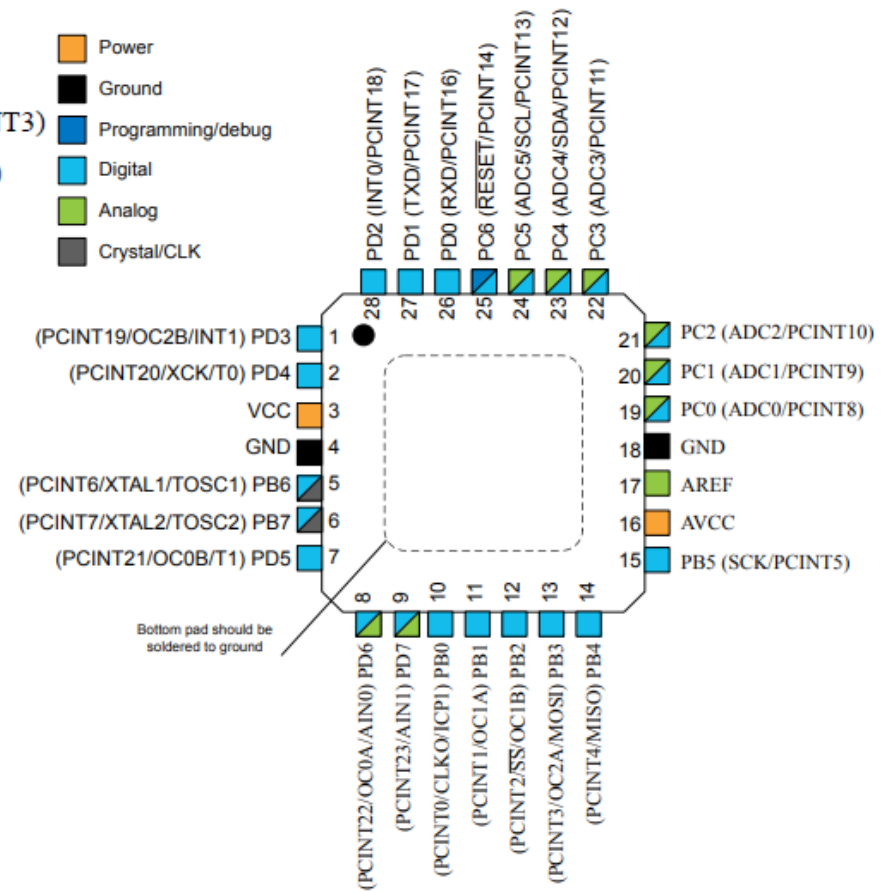
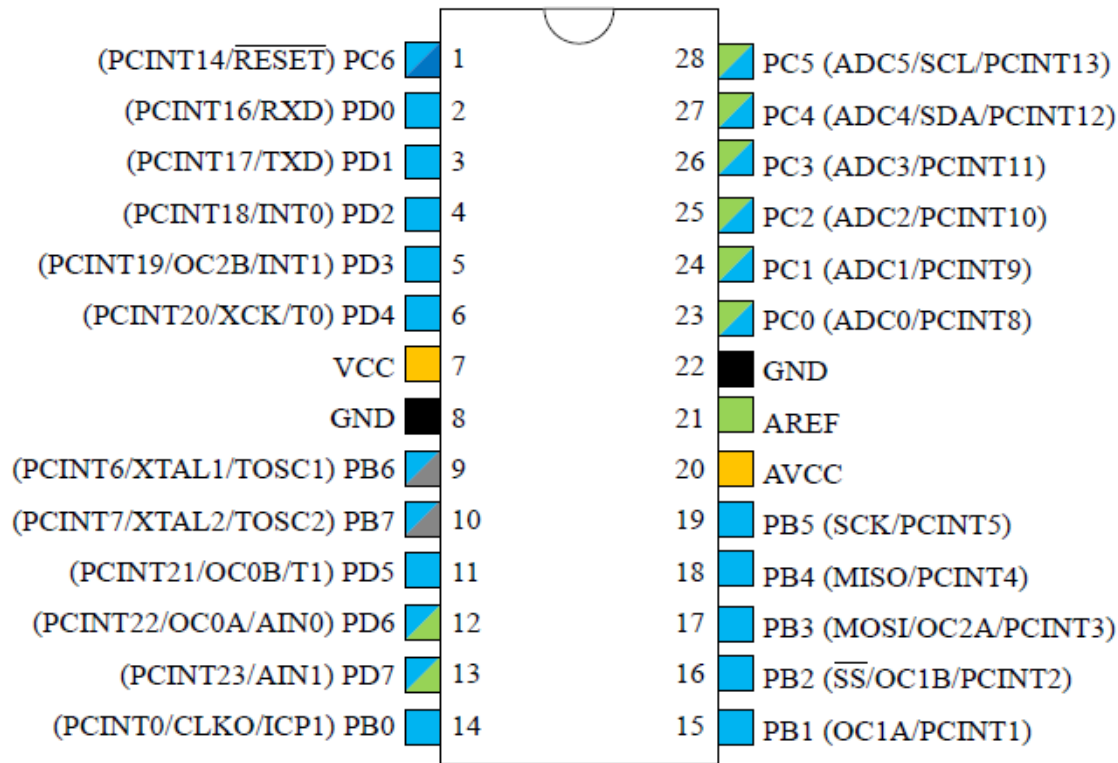
Model	Processor	Frequency	Voltage	Flash (kB)	EEPROM (kB)	Digital I/O (pins)	Analog input (pins)
LilyPad	ATmega168V or ATmega328V	8 MHz	2.7-5.5 V	16	0.5	14	6
Mega2560	Atmega2560	16 MHz	5 V	256	4	54	16
Nano	ATmega168 Or ATmega328	16 MHz	5 V	16/32	0.5/1	14	8
Uno	Atmega328P	16 MHz	5 V	32	1	14	6

Waarom Arduino ?



ATMEGA328





MEGA328 overzicht

RISC processor – 131 instructies – 32x8 registers - clock max. 20 Mhz

32k flash memory

2k SRAM

1k EEPROM

2 x 8 bit timers/counters

1 x 16 bit timer counter

1 x real time counter met separate oscillator

6 PWM-kanalen

8 kanalen 10 bit ADC (TQPF) – 6 kanalen 10 bit ADC (PDIP)

1 USART

1 master/slave SPI

1 2-draads seriele interface (I2C compatible)

Programmeerbare watchdog met separate oscillator

Analoge comparator

Interrupt en wake-up op Pin change

Watchdog

debugWIRE

Arduino versus Raspberry Pi

Arduino:

Ontwikkelford voor microcontrollers

Geen besturingssysteem

Beperkte kloksnelheid (16 MHz)

8 bit processor

Beperkte geheugen

32k flash-2k SRAM-512k EEPROM

Programmeertaal: C#

Raspberry P:

Complete computer

Met besturingssysteem

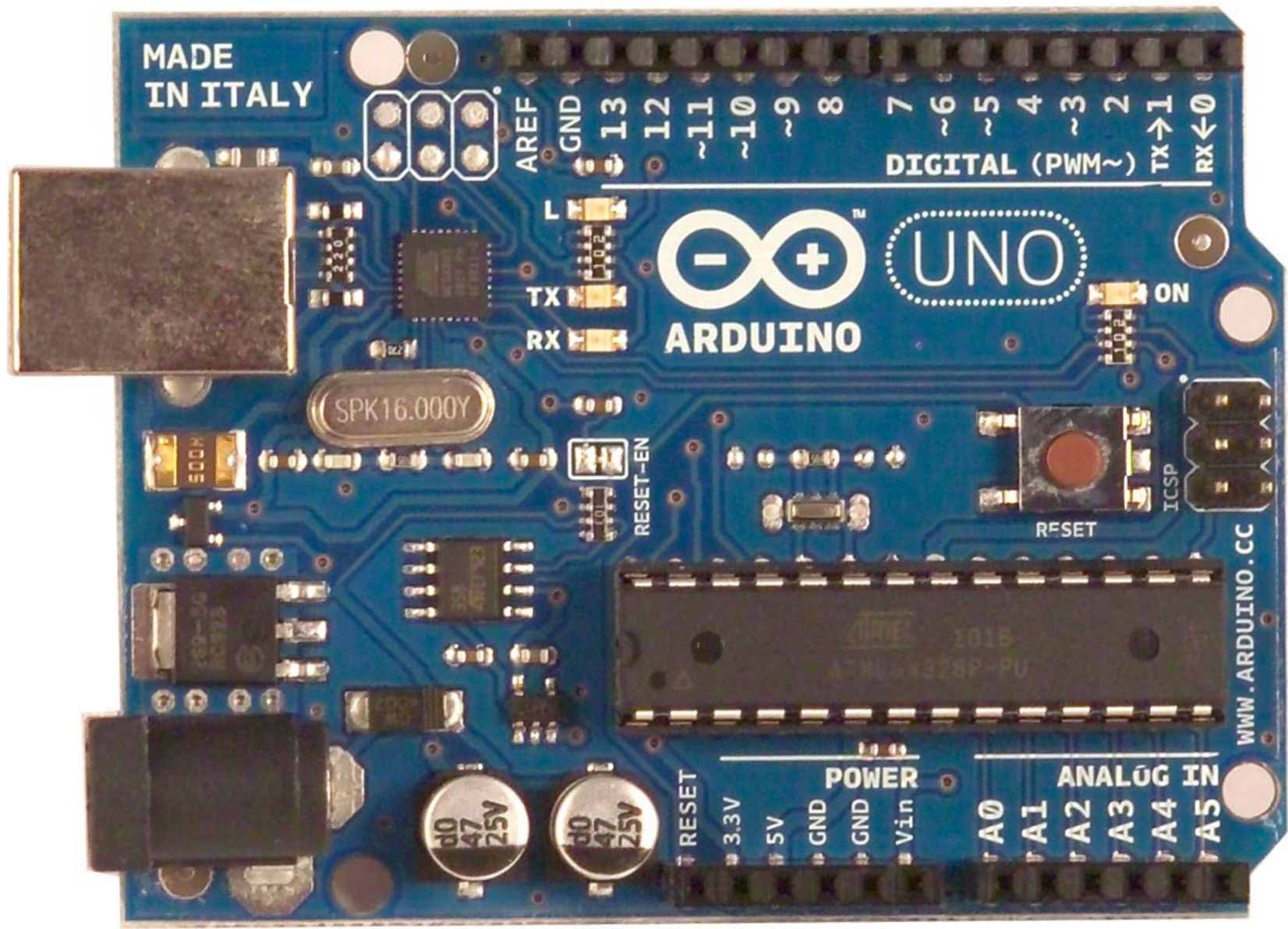
Kloksnelheid 900 Mhz

32-bit processor

Uitgebreid geheugen:

4 GB flash – 512k SRAM – microSD

Diverse programmeertalen (o.a. Python)



MADE
IN ITALY

AREF GND 13 12 ~11 ~10 ~9 8 7 6 5 4 3 2 1 0
DIGITAL (PWM~) TX→ RX←

ARDUINO UNO

SPK16.000Y

TX RX

RESET-EN

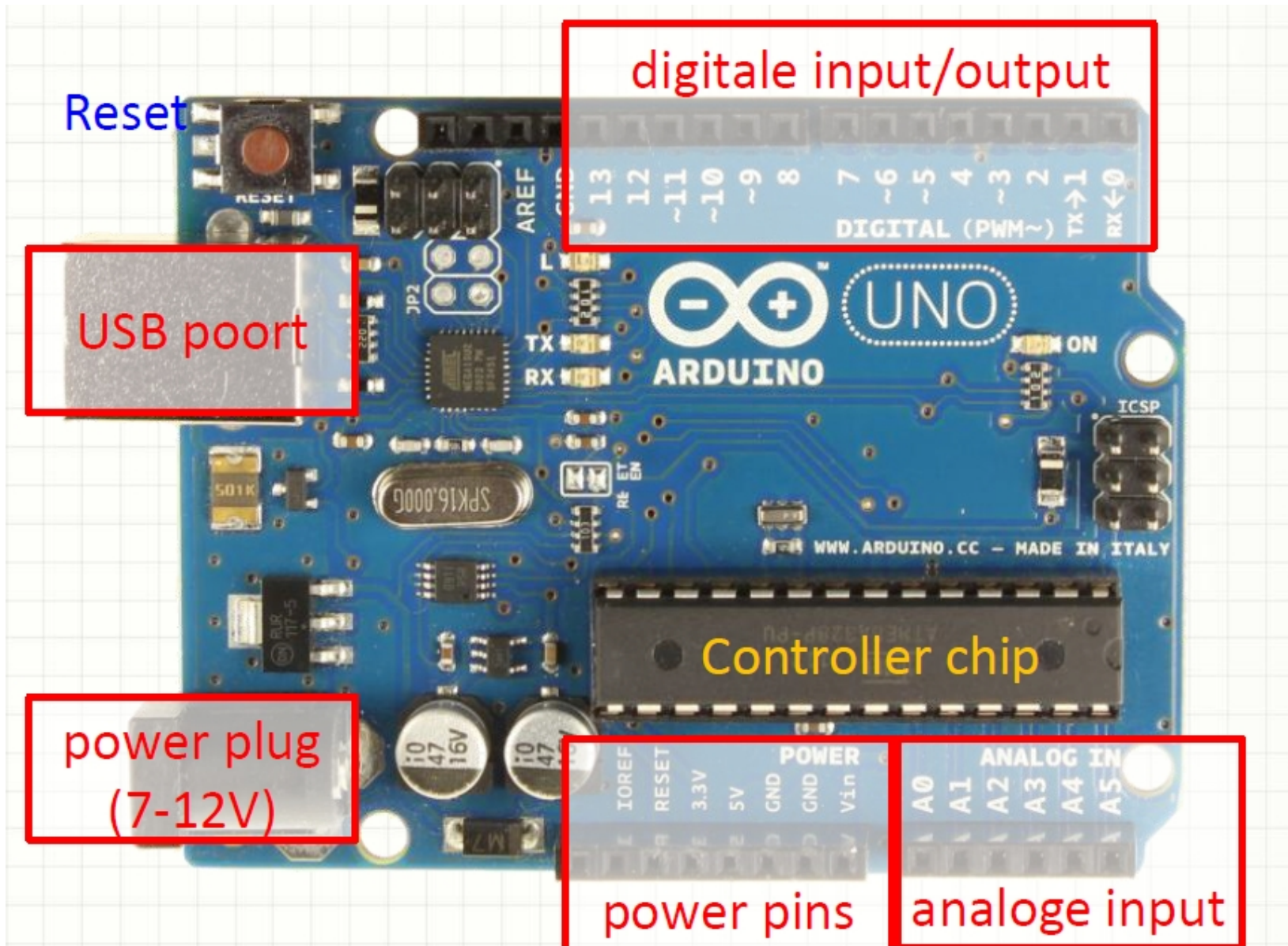
RESET

ICSP

WWW.ARDUINO.CC

RESET 3.3V 5V GND GND Vin

ANALOG IN A0 A1 A2 A3 A4 A5

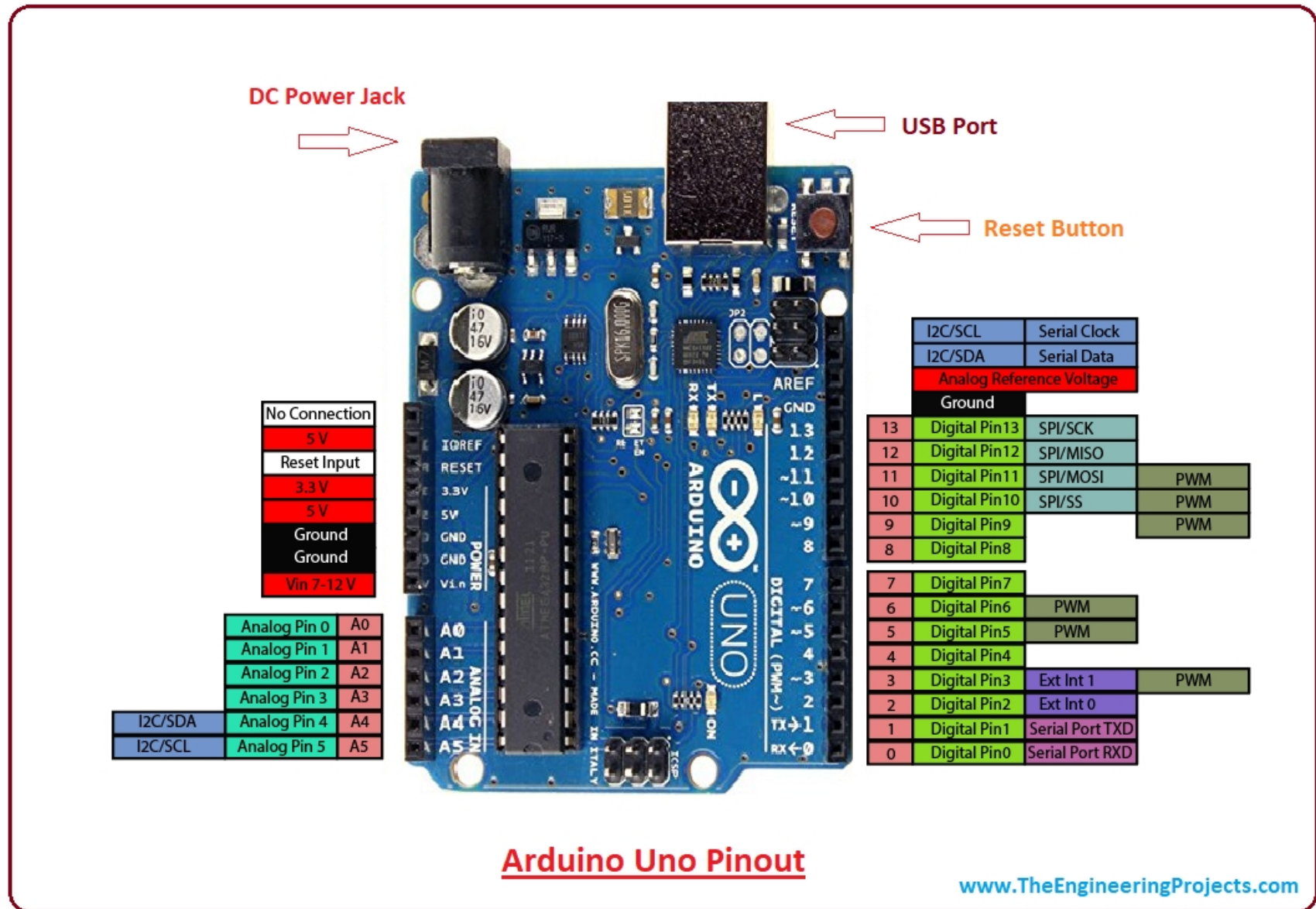


ATMega328P and Arduino Uno Pin Mapping

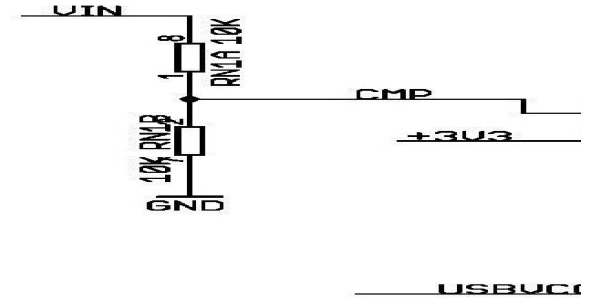
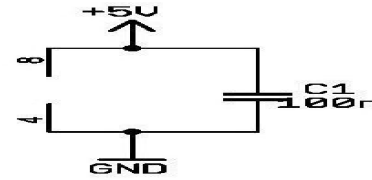
Arduino function					Arduino function
reset	(PCINT14/RESET) PC6	1	28	PC5 (ADC5/SCL/PCINT13)	analog input 5
digital pin 0 (RX)	(PCINT16/RXD) PD0	2	27	PC4 (ADC4/SDA/PCINT12)	analog input 4
digital pin 1 (TX)	(PCINT17/TXD) PD1	3	26	PC3 (ADC3/PCINT11)	analog input 3
digital pin 2	(PCINT18/INT0) PD2	4	25	PC2 (ADC2/PCINT10)	analog input 2
digital pin 3 (PWM)	(PCINT19/OC2B/INT1) PD3	5	24	PC1 (ADC1/PCINT9)	analog input 1
digital pin 4	(PCINT20/XCK/T0) PD4	6	23	PC0 (ADC0/PCINT8)	analog input 0
VCC	VCC	7	22	GND	GND
GND	GND	8	21	AREF	analog reference
crystal	(PCINT6/XTAL1/TOSC1) PB6	9	20	AVCC	VCC
crystal	(PCINT7/XTAL2/TOSC2) PB7	10	19	PB5 (SCK/PCINT5)	digital pin 13
digital pin 5 (PWM)	(PCINT21/OC0B/T1) PD5	11	18	PB4 (MISO/PCINT4)	digital pin 12
digital pin 6 (PWM)	(PCINT22/OC0A/AIN0) PD6	12	17	PB3 (MOSI/OC2A/PCINT3)	digital pin 11 (PWM)
digital pin 7	(PCINT23/AIN1) PD7	13	16	PB2 (SS/OC1B/PCINT2)	digital pin 10 (PWM)
digital pin 8	(PCINT0/CLKO/ICP1) PB0	14	15	PB1 (OC1A/PCINT1)	digital pin 9 (PWM)

Digital Pins 11, 12 & 13 are used by the ICSP header for MOSI, MISO, SCK connections (Atmega168 pins 17, 18 & 19). Avoid low-impedance loads on these pins when using the ICSP header.

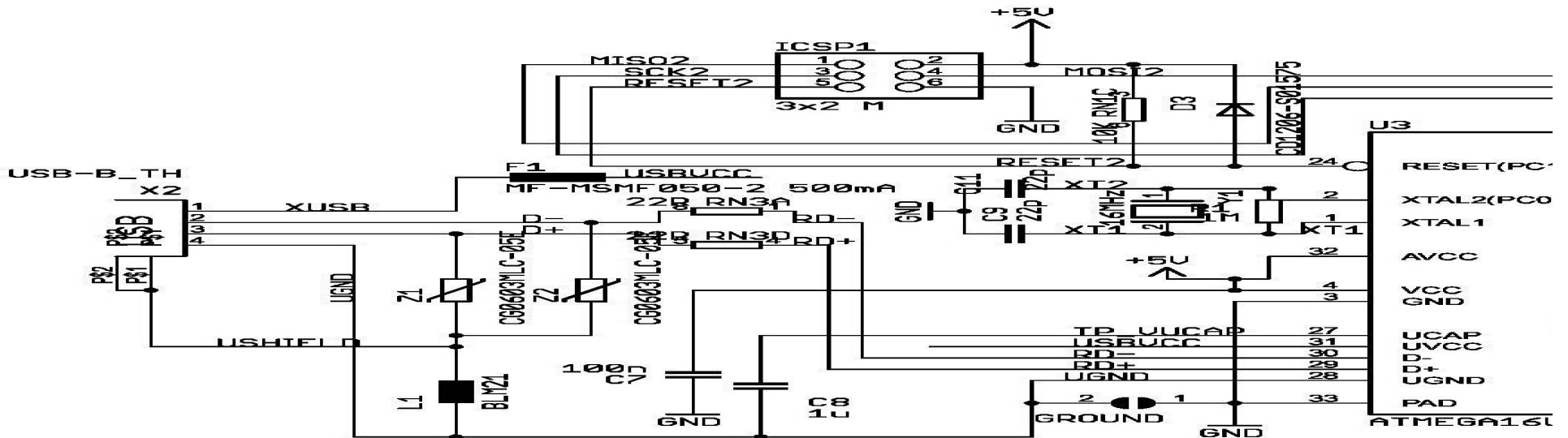
Arduino uno aansluitingen



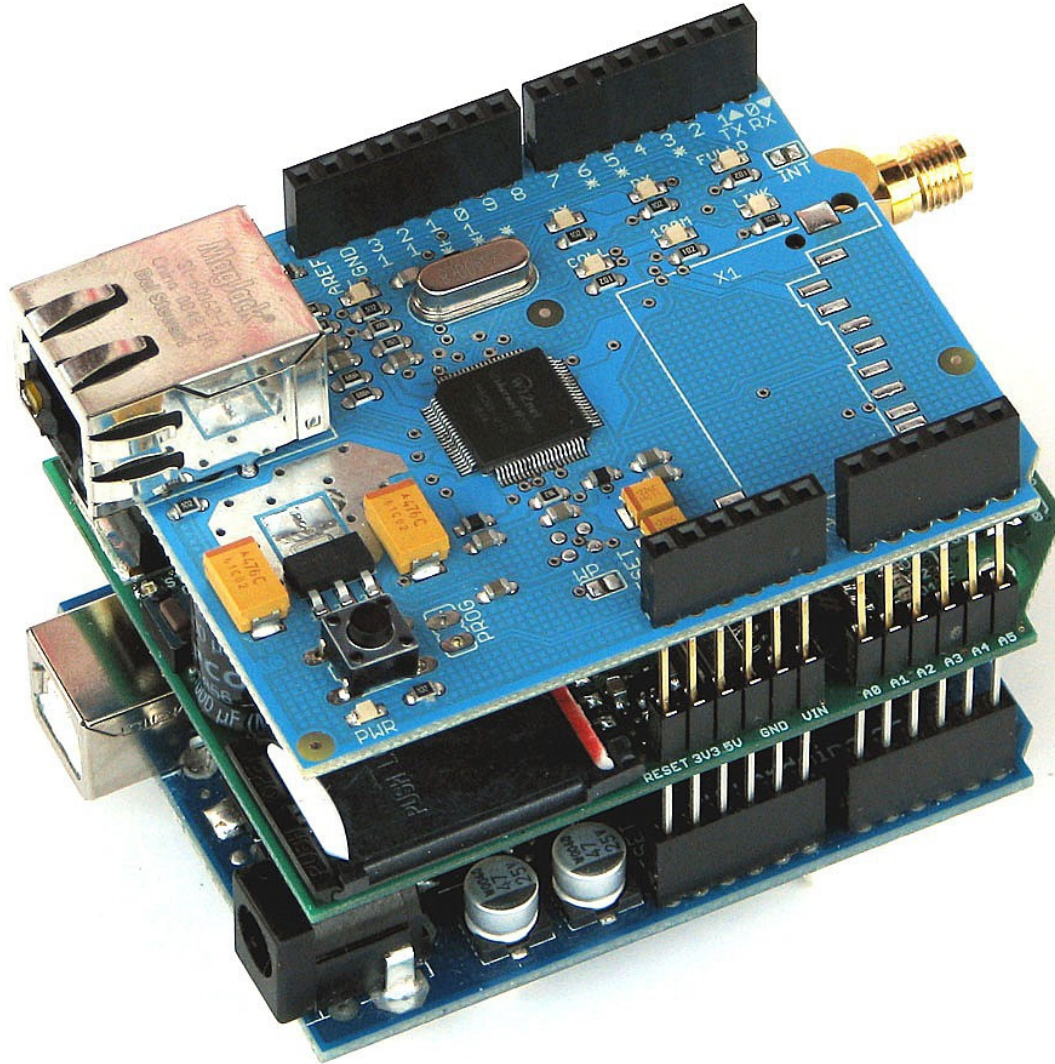
Arduino Uno schema



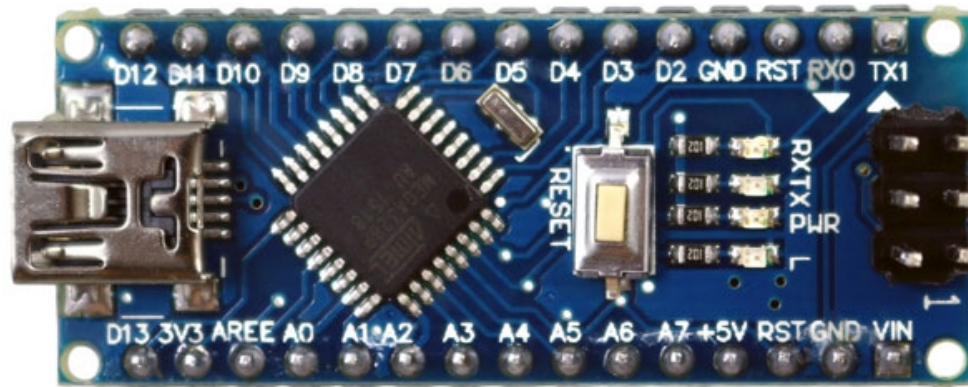
Arduino(TM) UNO R

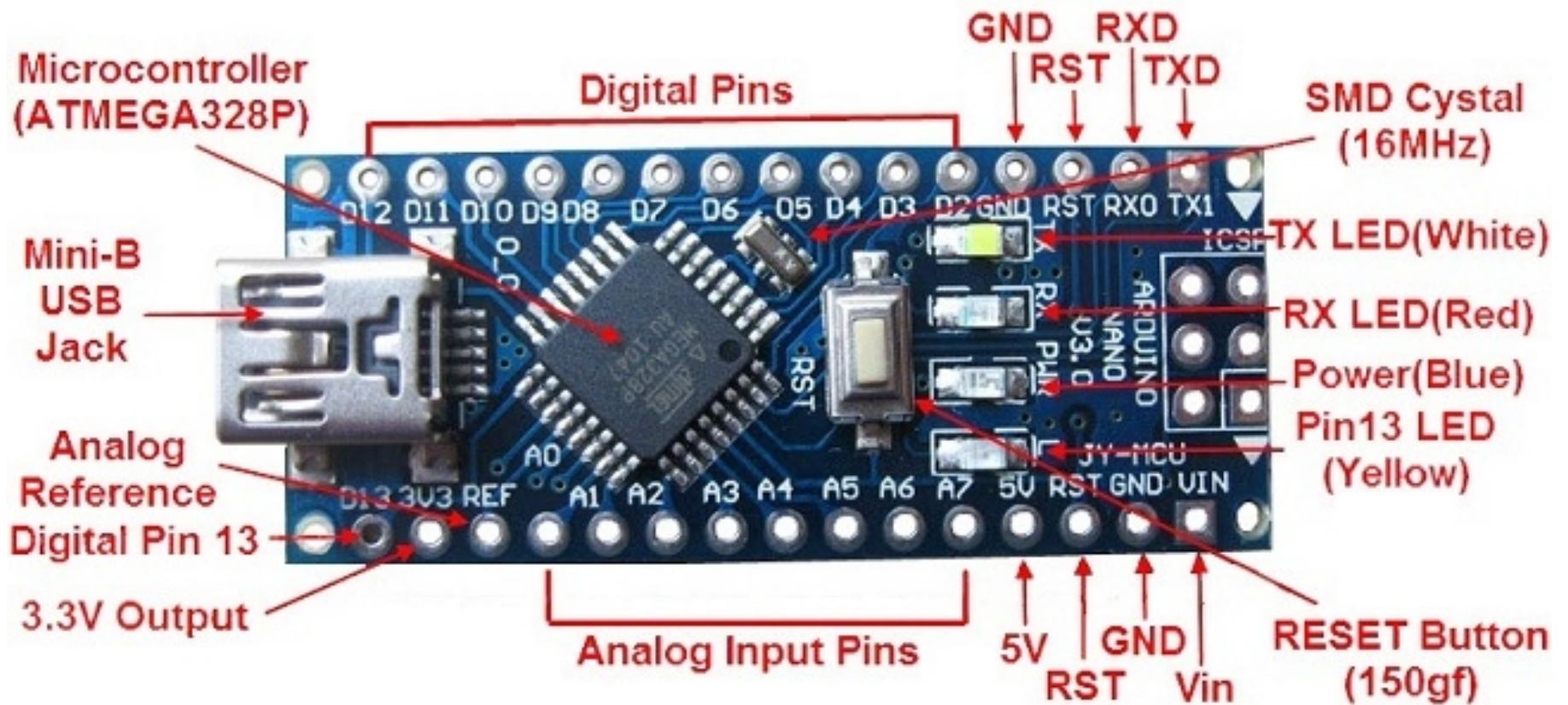


UNO uitgebreid met 'shields'



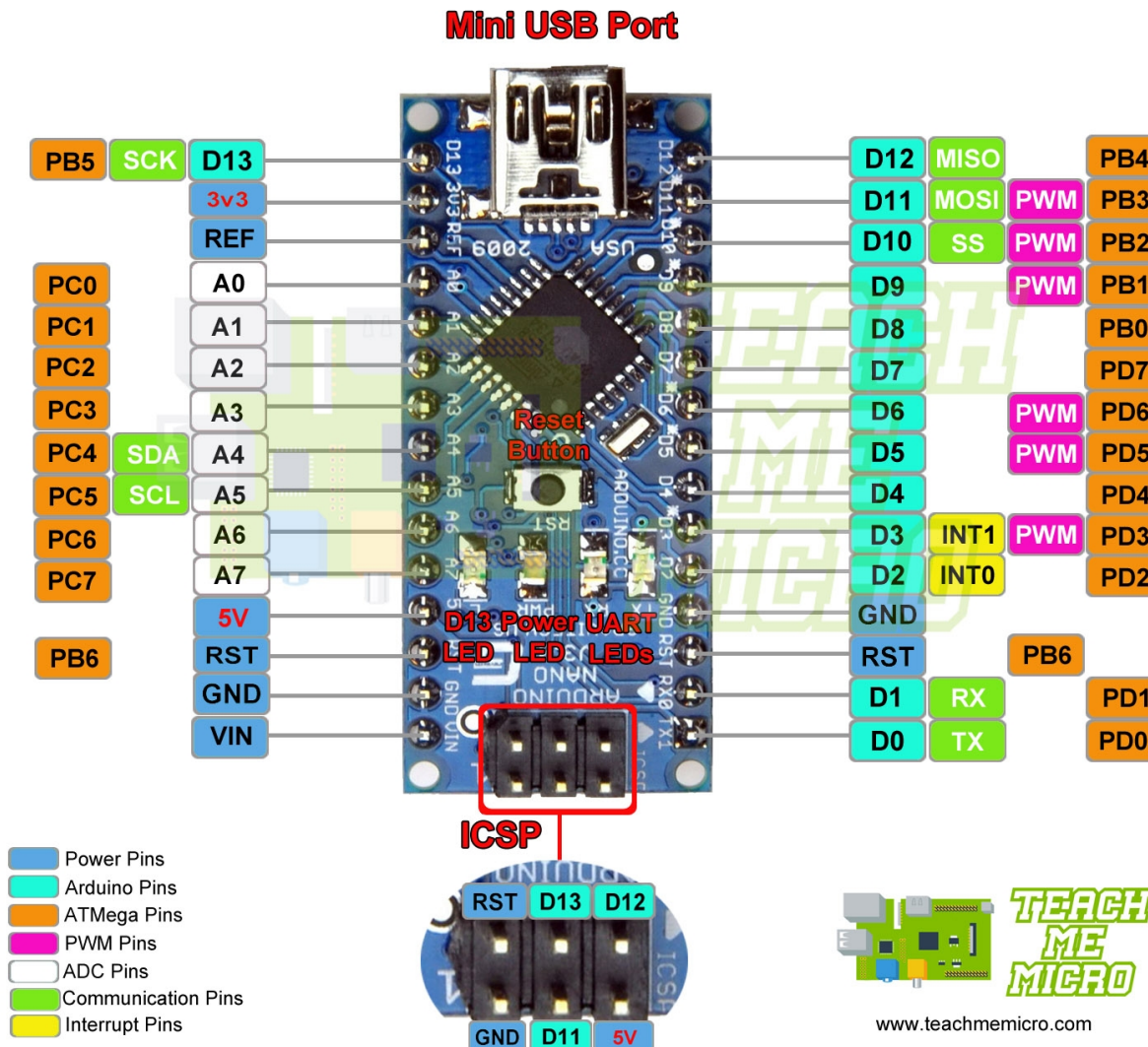
ARDUINO NANO



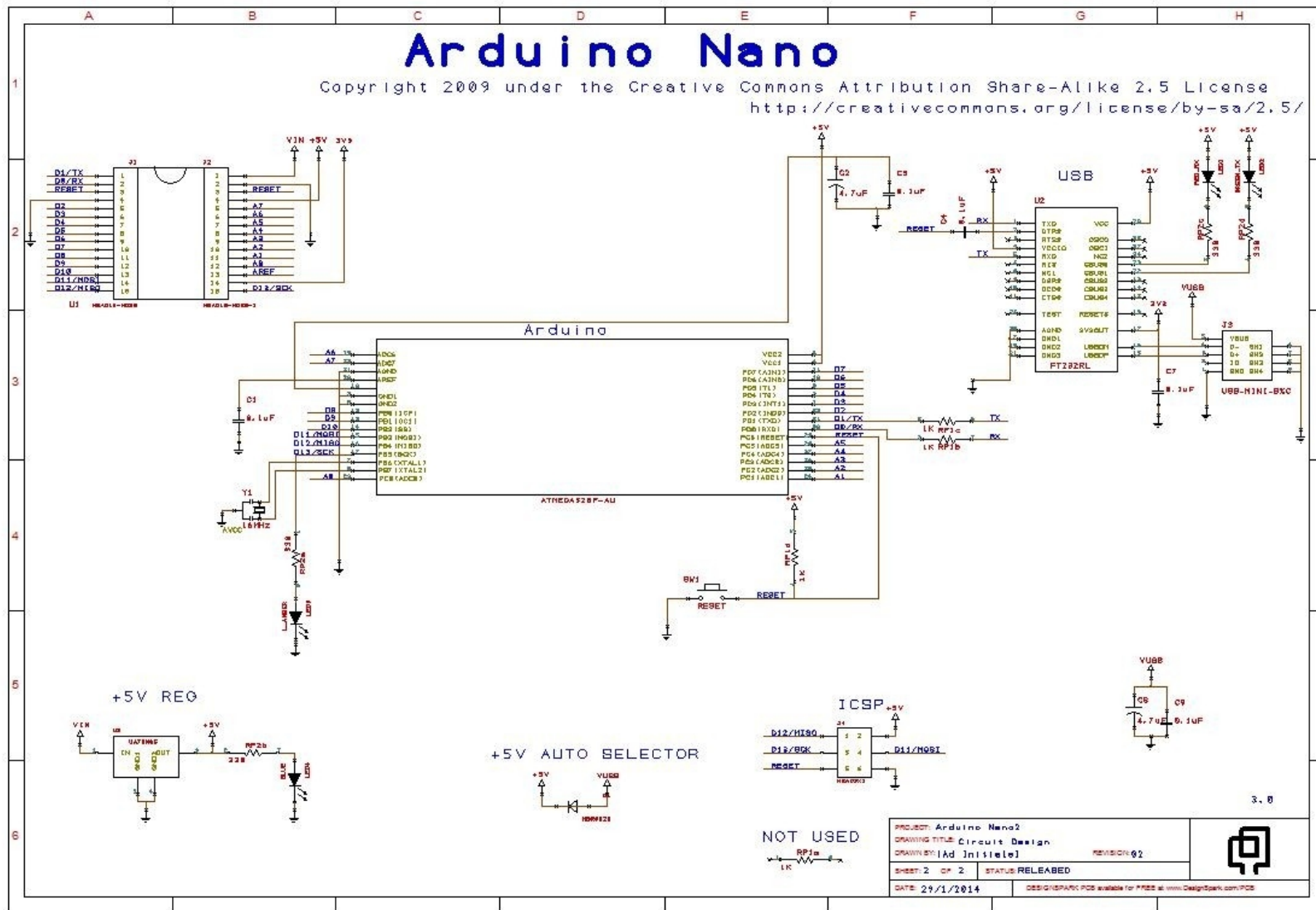


Arduino Nano aansluitingen

ARDUINO NANO PINOUT



Arduino Nano



Vershil uno - nano

Name	Processor	Operating/Input Voltage	CPU speed	Analog In/Out	Digital IO/PWM	EEPROM / SRAM[kB]	Flash	USB	USART
Uno	ATmega328P	5V / 7-12V	16 MHz	6 / 0	14 / 6	1 / 2	32	Regular	1
Nano	ATmega328P	5V / 7-12V	16 MHz	8 / 0	14 / 6	1 / 2	32	Mini	1



UNO OF NANO ?

UNO:

- Duurder
- Beter geschikt om te experimenteren
- Te combineren met breadboard

NANO:

- Goedkoop
- Beter geschikt voor definitieve inbouw

Deel 2

Bedrijfsklaar maken van de arduino

INSTALLATIE VAN DE HARDWARE

1. Voeding

UNO: voeding via USB of externe 8V (max 12V)
voeding (centrale pen is +)

NANO: via experimenteerboard

Experimenteerboard: voeding via USB of externe
voeding 8V (max 12V) (centrale pen is +)

2. USB-kabel

UNO: USB-A naar USB-B

NANO: USB-A naar USB-mini

Sluit de USB pas aan na installatie van de IDE!

Installatie van de IDE

Sluit de Arduino nog niet aan op je computer! Voer eerst de volgende stappen uit:

- Stap 1: download de IDE van www.arduino.cc
- Stap 2: Kies SOFTWARE→DOWNLOADS
- Stap 3: Kies het juiste besturingssysteem
- Stap 4: Kies [Just Download](#) (of Donate...)
- Stap 5: Kies [Weergeven in map](#)
- De uitvoerbare file [ARDUINO-1.8.10-windows](#) wordt gedownload.

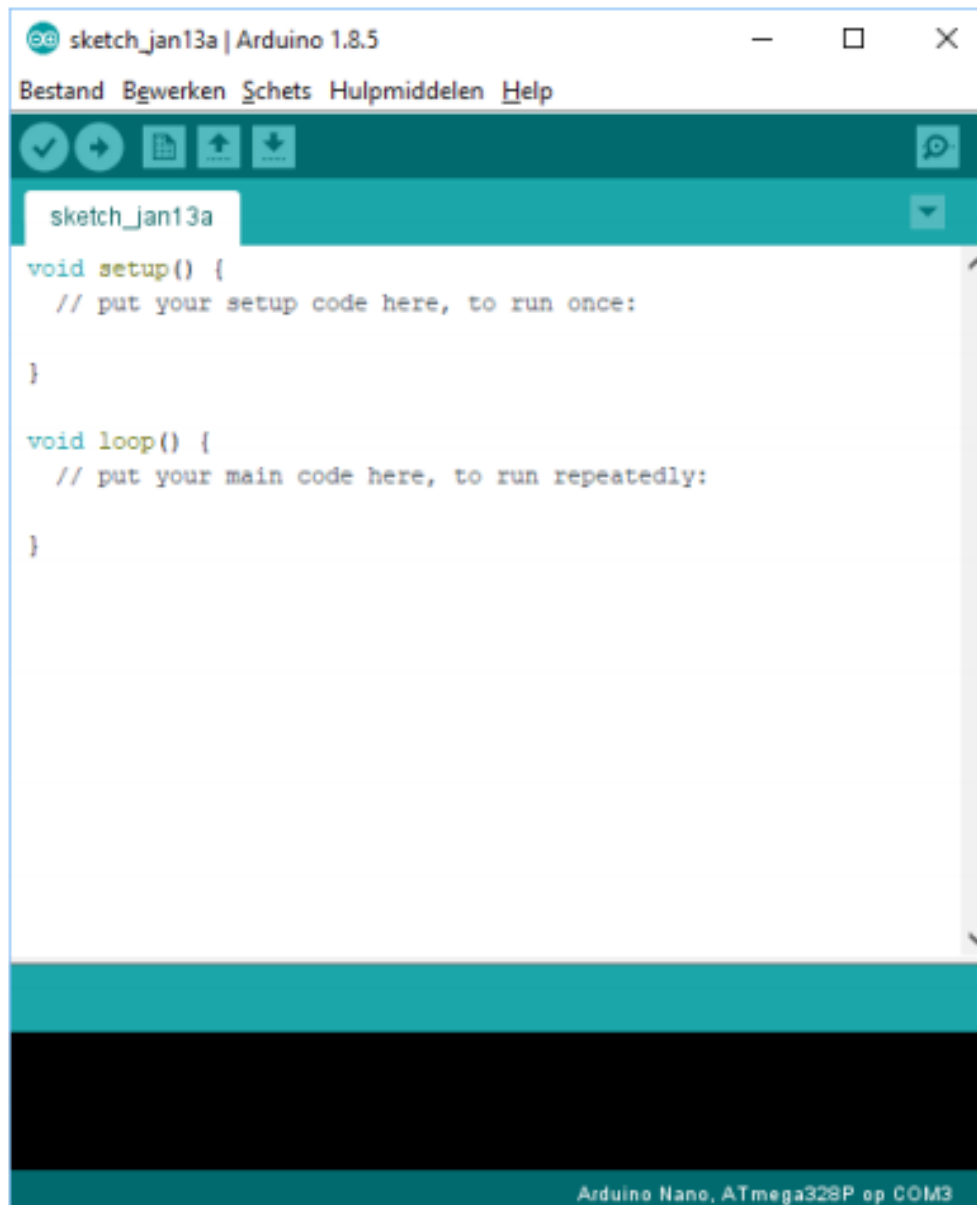
- Stap 6: Sla het exe-bestand op en start het
- Stap 7: Kies de te installeren componenten (**alle**)
- STAP 8: Kies **NEXT**, en kies de map om de bestanden op te slaan
- STAP 8: Na installatie, kies **CLOSE**

Sluit nu pas de ARDUINO aan op een USB-poort

Je bent nu klaar om met de Arduino te werken.

Open de Arduino-IDE (via het icoontje of het menu START.

Je krijgt het volgende scherm te zien:

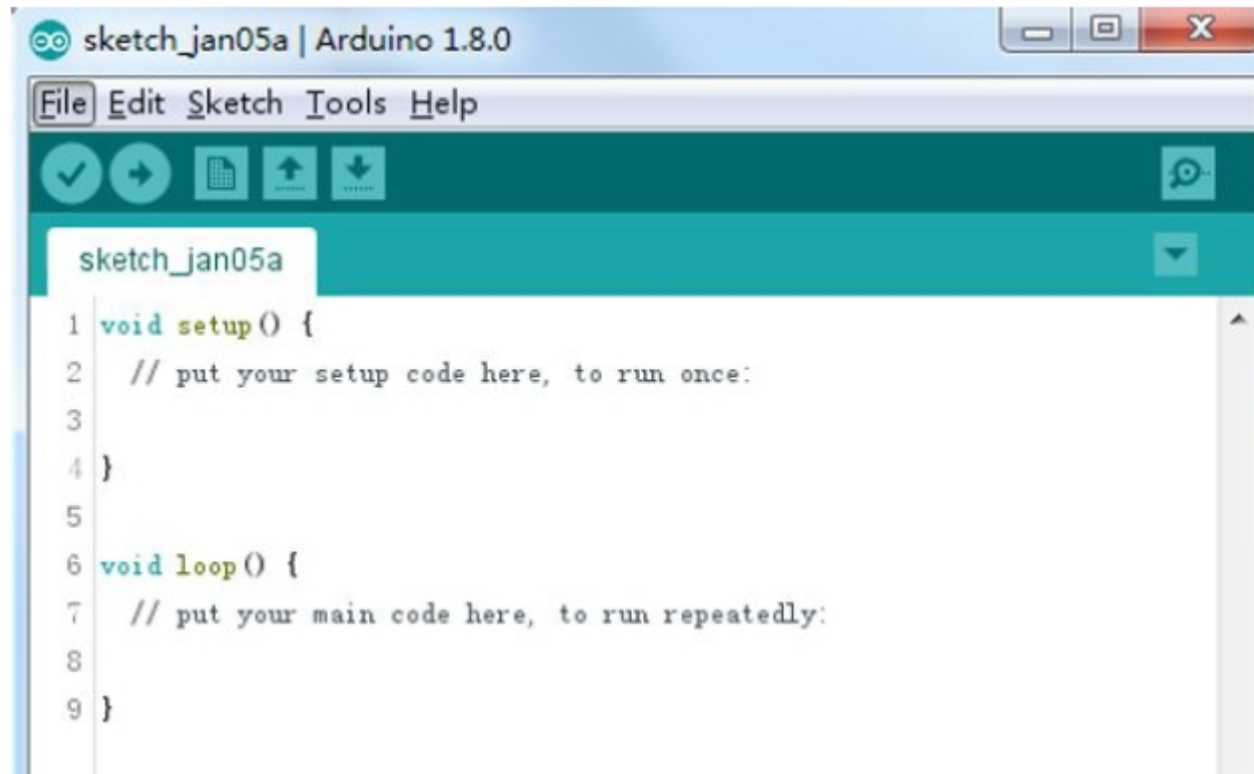


The image shows a screenshot of the Arduino IDE interface. The window title is "sketch_jan13a | Arduino 1.8.5". The menu bar includes "Bestand", "Bewerken", "Schets", "Hulpmiddelen", and "Help". The toolbar contains icons for check, run, upload, and download. The sketch name "sketch_jan13a" is displayed in the top left of the editor area. The code in the editor is as follows:

```
void setup() {  
  // put your setup code here, to run once:  
  
}  
  
void loop() {  
  // put your main code here, to run repeatedly:  
  
}
```

The status bar at the bottom right indicates "Arduino Nano, ATmega328P op COM3".

Eerste keer met Arduino-IDE

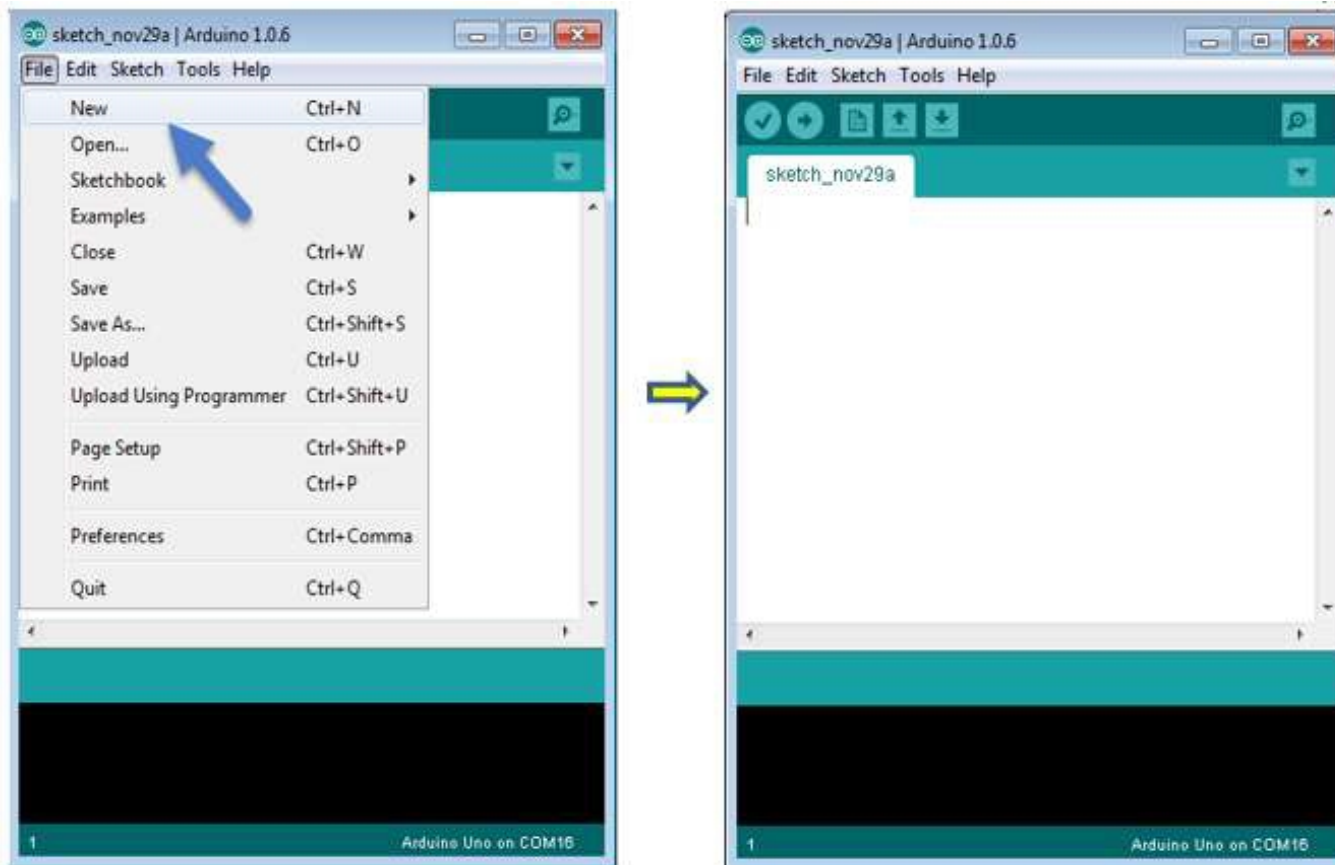


```
sketch_jan05a | Arduino 1.8.0
File Edit Sketch Tools Help
sketch_jan05a
1 void setup() {
2 // put your setup code here, to run once:
3
4 }
5
6 void loop() {
7 // put your main code here, to run repeatedly:
8
9 }
```

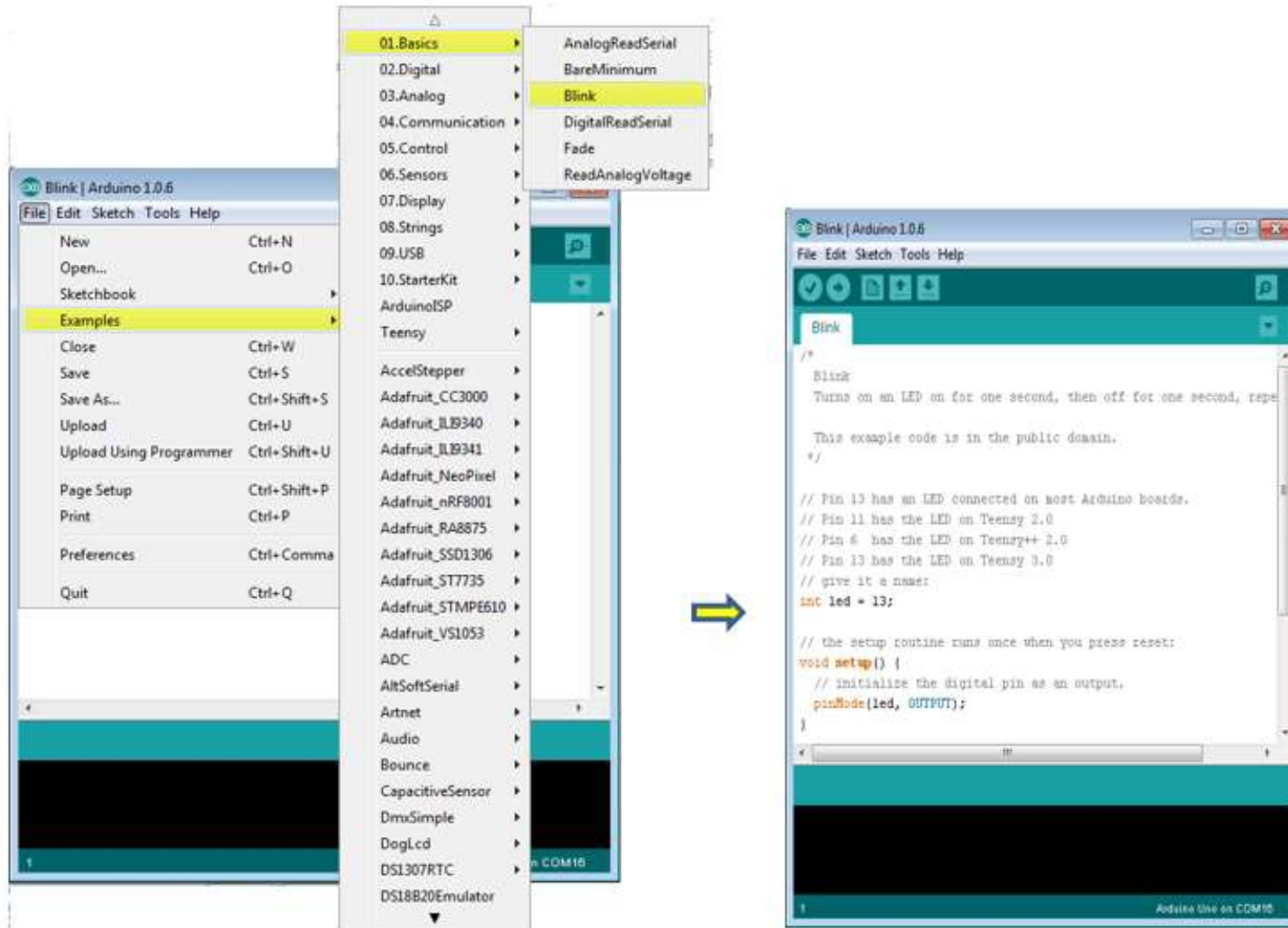
1. Via **TOOLS** → **BOARD** om het juiste arduinobordje te kiezen (UNO of NANO)
2. Via **TOOLS** → **PORT** om de juiste USB-poort te kiezen (is meestal al juist)
3. Klaar voor het eerste project!

Een eerste sketch (=arduinoprogramma)

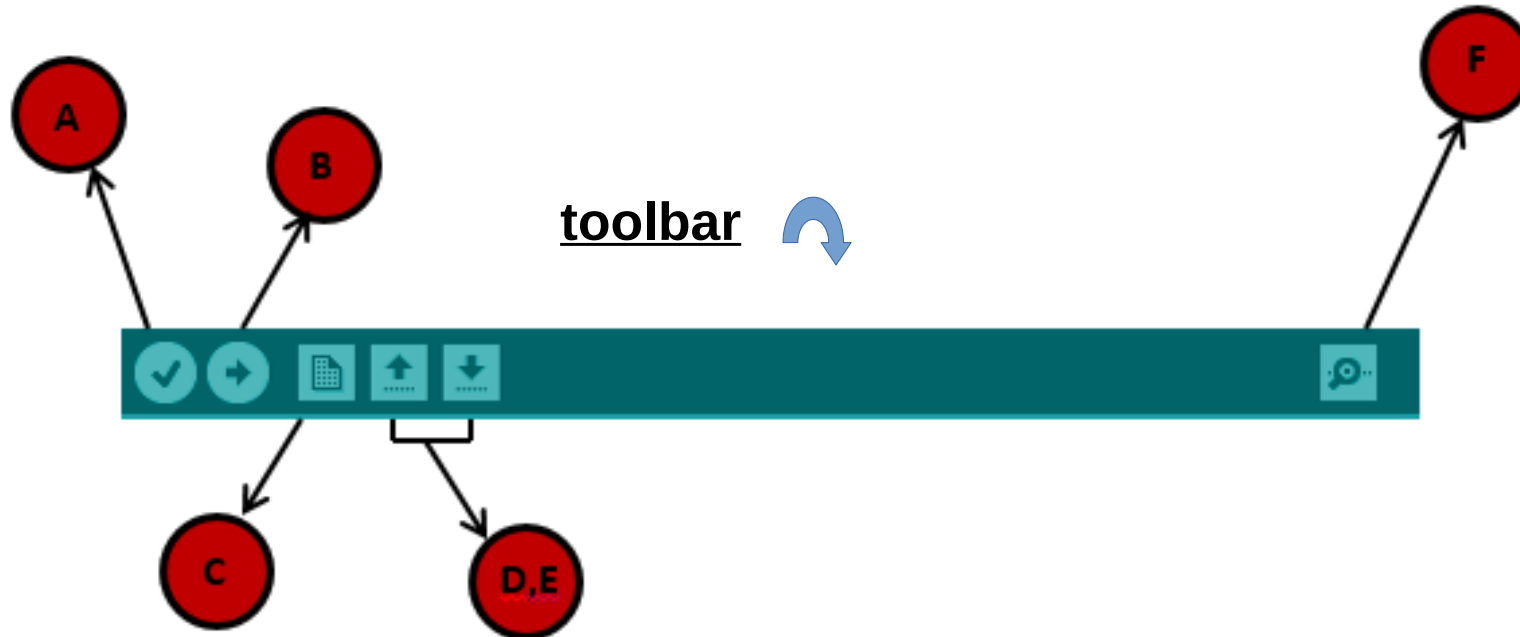
- Openen van een bestaand programma: File→Open...



• Kies: FILE->EXAMPLE->BASICS->BLINK



- UPLOAD JE SKETCH



A: check op compilatie-fout

B: uploaden

C: starten met een nieuwe sketch

D: Openen van een bestaande sketch

E: Opslaan van een sketch

F: Start de monitor

KLIK OP B: RX/TX led op het board knippert tijdens loaden



1,2,3...de procesgang

opstap naar les 1

- 1. Programma schrijven in C#
- 2. Programma checken op syntax
- 3. Programma uploaden
- 4. Programma testen op logica



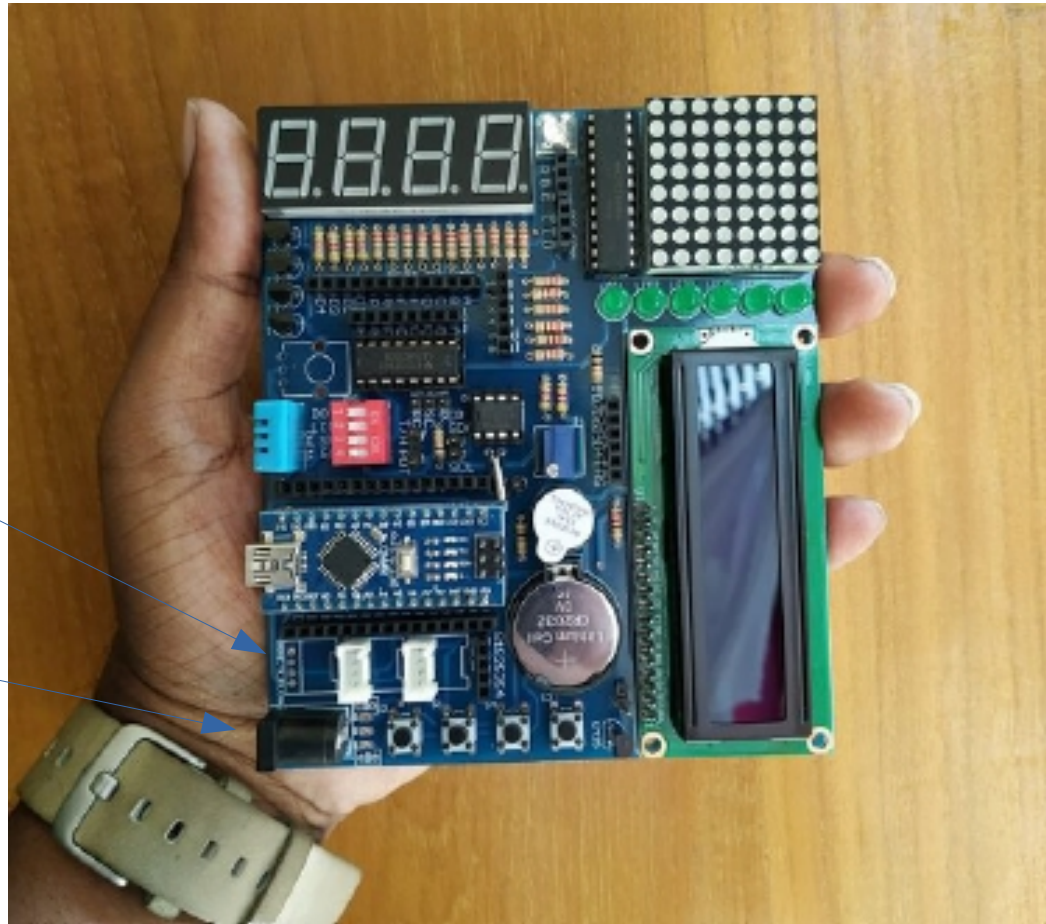
Deel 3

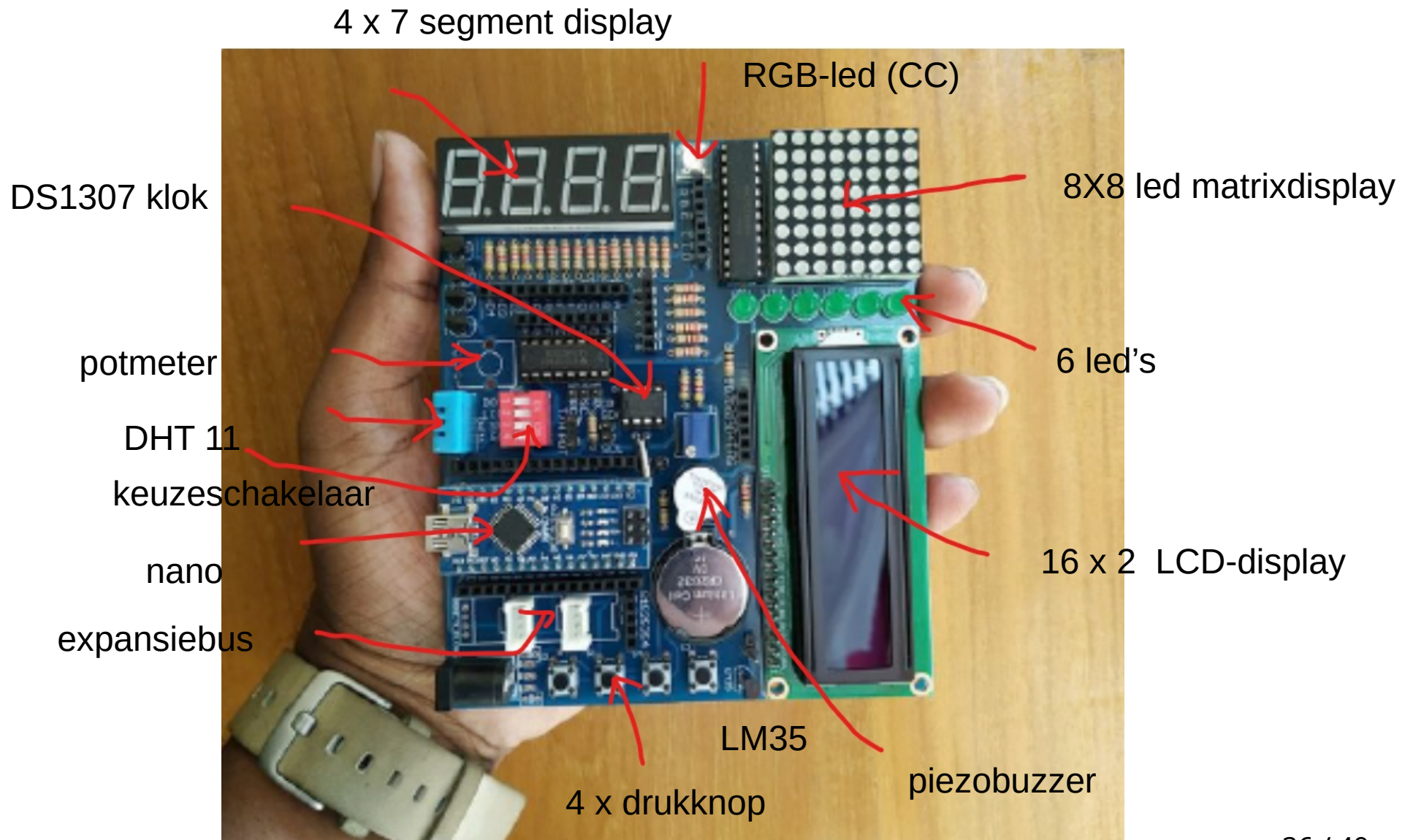
Het experimenteerboard

Arduino nano experimenteerboard

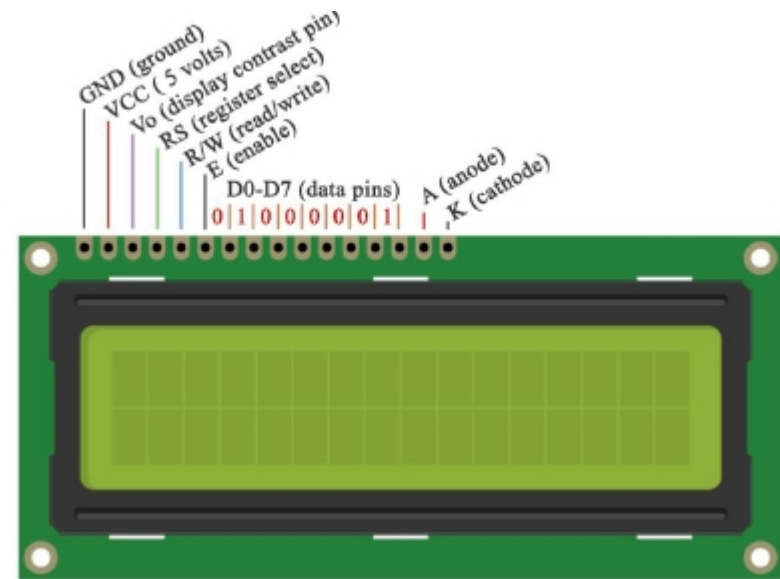
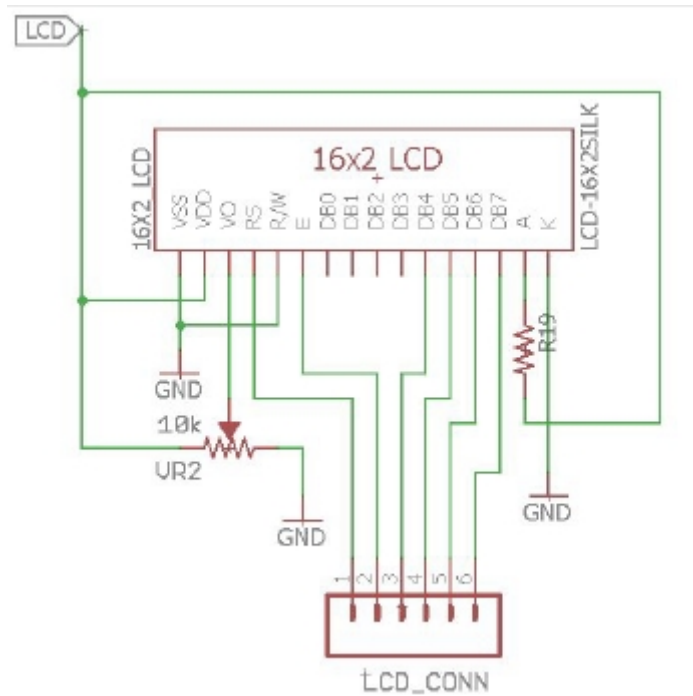
Expansiebus
RX/TX – I2C – GPIO
2 mm pinafstand!

8-12V DC
Centrale pin = +



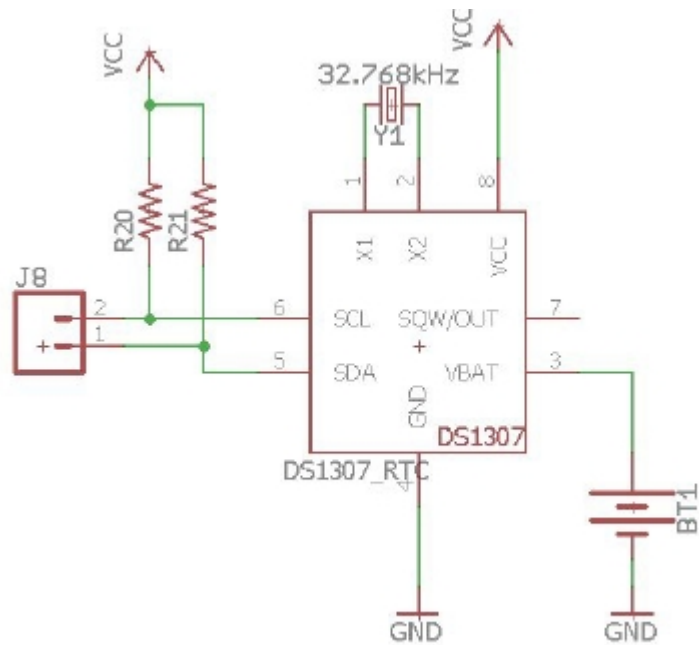


- 16 x 2 LCD DISPLAY

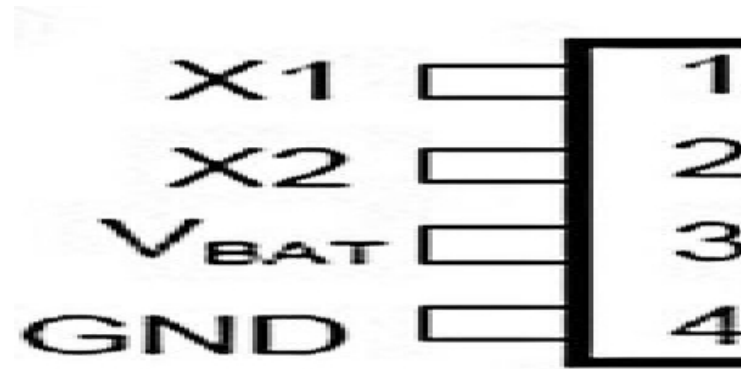


Parallel interface (2 nibbles)

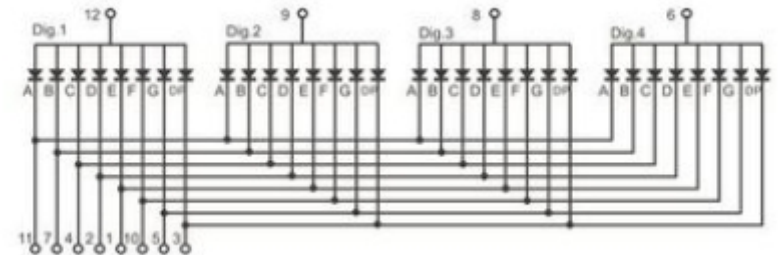
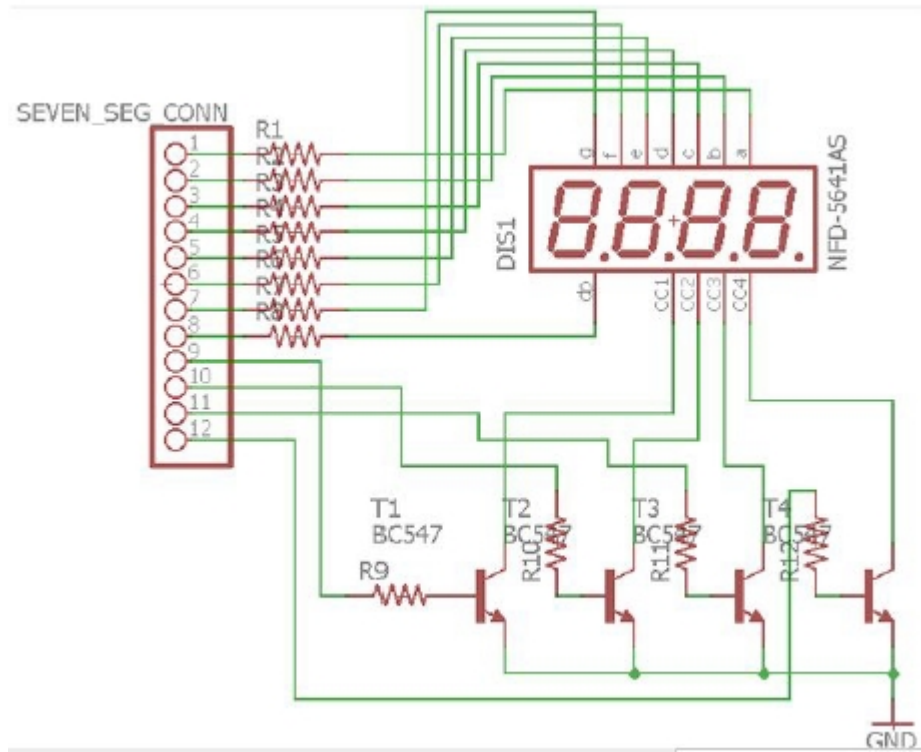
- Bordklok (tijd, datum,...)



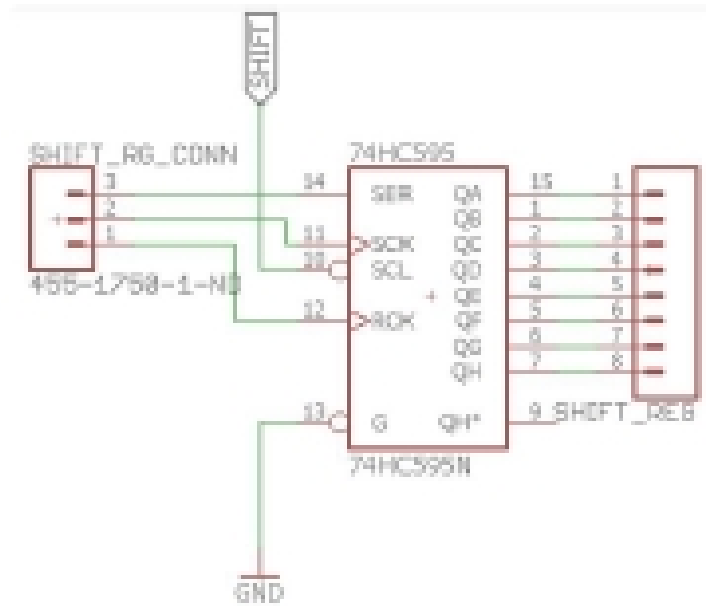
S



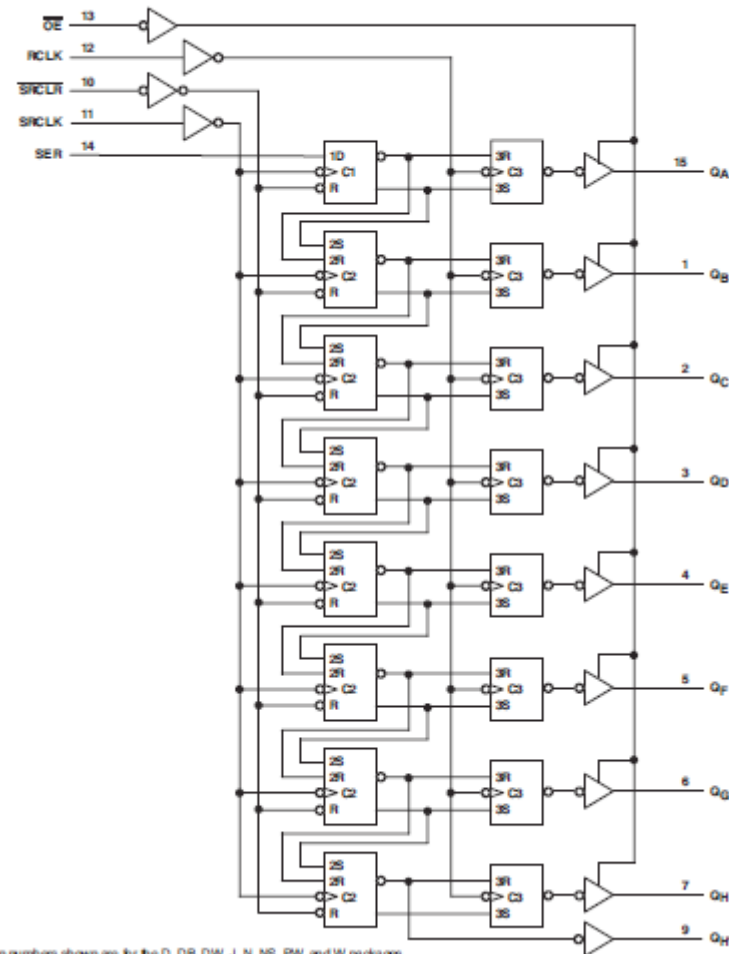
- 4 x 7-segment display (CA)



- SCHUIFREGISTER 74H595

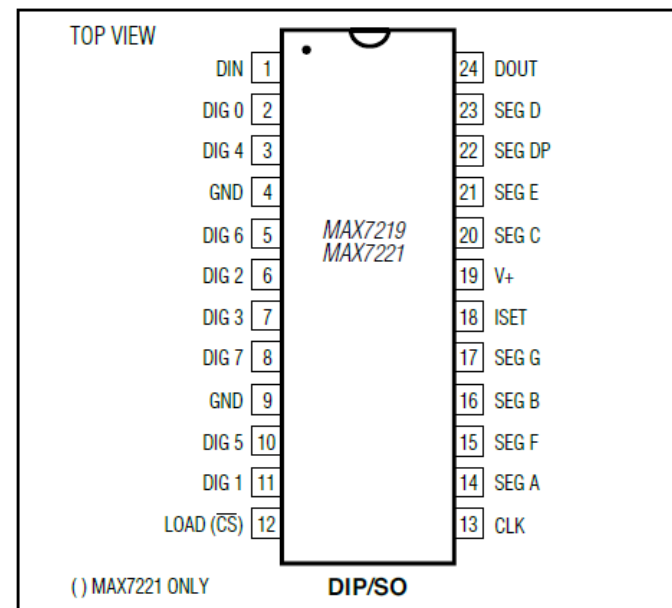
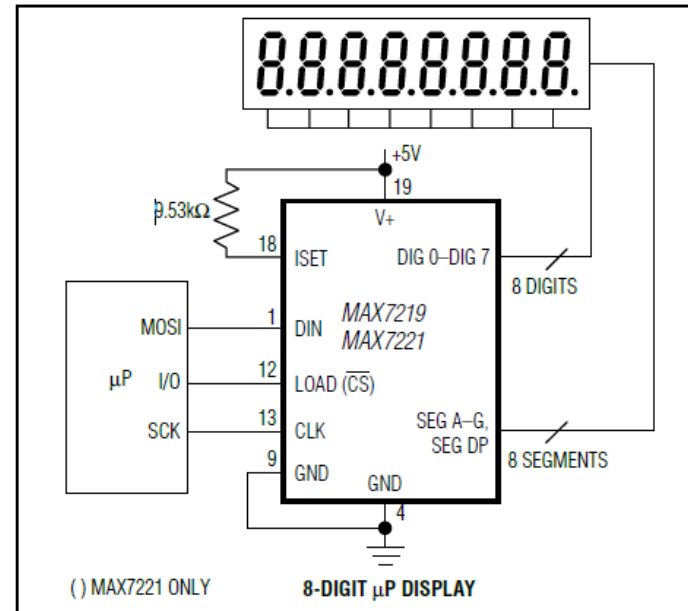
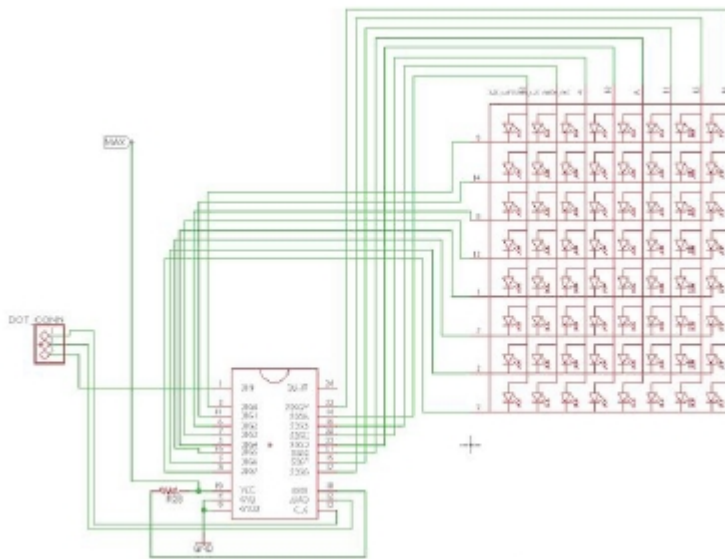


Logic Diagram (Positive Logic)



Pin numbers shown are for the D, DB, DW, J, N, NS, PW, and W packages.

- 8 x 8 ledmatrix met MAX7219 driver (SPI)





- Overigen

- Temperatuur- en vochtigheidssensor DHT11
- Temperatuursensor LM35
- Drukknoppen (4x)
- Potmeter
- LED's (met serieweerstand)
- Keuzeschakelaars (4x): Max7819, LCD, shiftregister, expansiebus (**aan/uit**)



documentatie

- Website: www.arduino.cc
- Website: www.arduino.cc/reference/en/
- Website: www.arduino-lesSEN.nl
- Documentatie op memory stick:
 - map aanvullende documentatie
 - map cursusmateriaal
 - map libraries
 - map literatuur
 - map projecten
 - map trainer



Deel 4


Achteruitblik

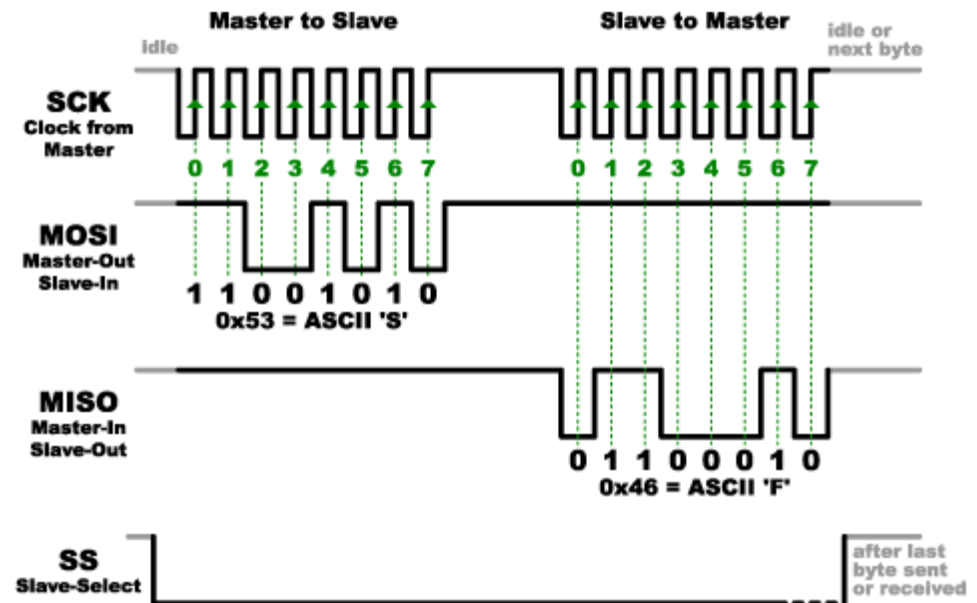
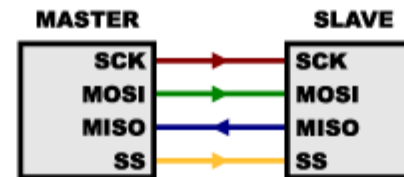
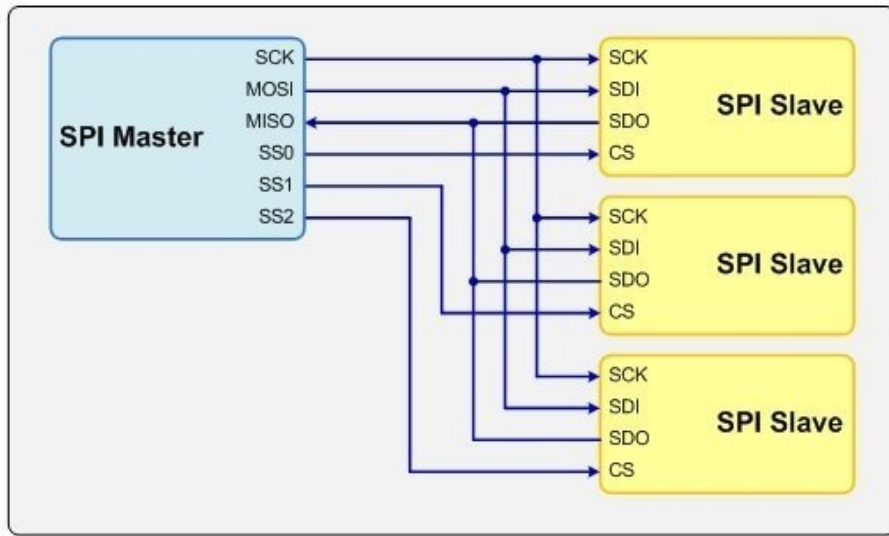
Vooruitblik

Lestijden

AANVULLING: SPI

- SPI = serial peripheral interface
- Synchrone seriele full duplex communicatie
- 1 master; 1 slave
- Meer slaves? Alleen van chip-select (-SS)
- 3 lijnen:
 - **SCLK**: klok geleverd door master
 - **MOSI** (master output, slave input)
 - **MISO** (master input, slave output)

- 
- Klokfrequ. kan tussen 1 MHz en 100 MHz liggen
 - Niet volledig gestandaardiseerd protocol!
 - SS moet L zijn of overgang van H → L
 - Soms wachttijd nodig voor sturen klokpuls
 - Zowel master als slave mogen gelijktijdig 1 bit versturen per klokpuls.
 - Master opereert over MOSI-lijn; slave over MISO





afspraken

- Lestijden
- USB-stick ivm aanvulling documentatie
- huiswerk
- Power point na elke sessie
- w.v.t.t.k.

**En toen kwam er een varken met een lange snuit
en het verhaaltje is uit**

