



Vhodno izhodne naprave

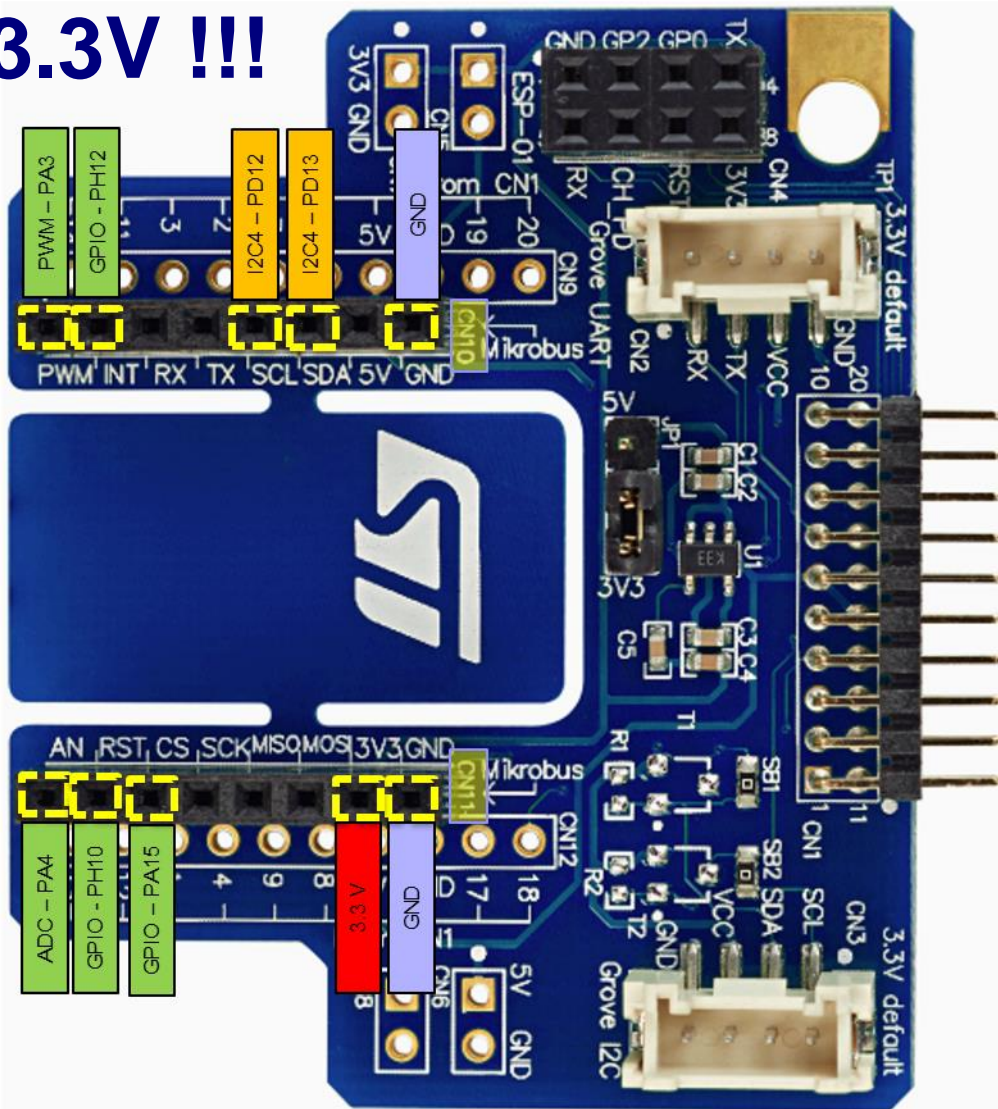
Laboratorijska vaja 5 - VP 5
STM32-CubeIDE projekt, breadboard
vezave

VIN projekt - VP5: STM32-CubeIDE projekt, breadboard vezave

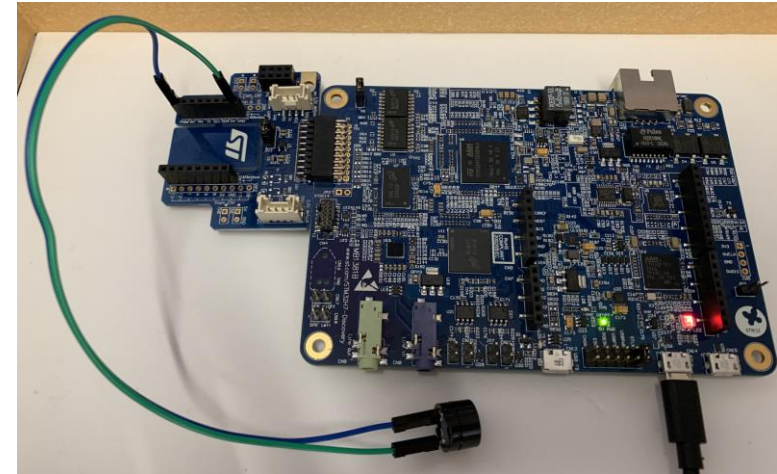
- Osvežitev: STM32 sistema
 - STM32H7
 - STM32F4
- Priprava na povezovanje
- STM32 CubeIDE + Breadboard
 - LED, tipka, potenciometer, uporovna tipala
 - STM32H7
 - STM32F4
- DN2-VP3: Breadboard + STM32

STM32H750B – DISCOVERY StMod+ konektor

3.3V !!!



Pravilna priključitev



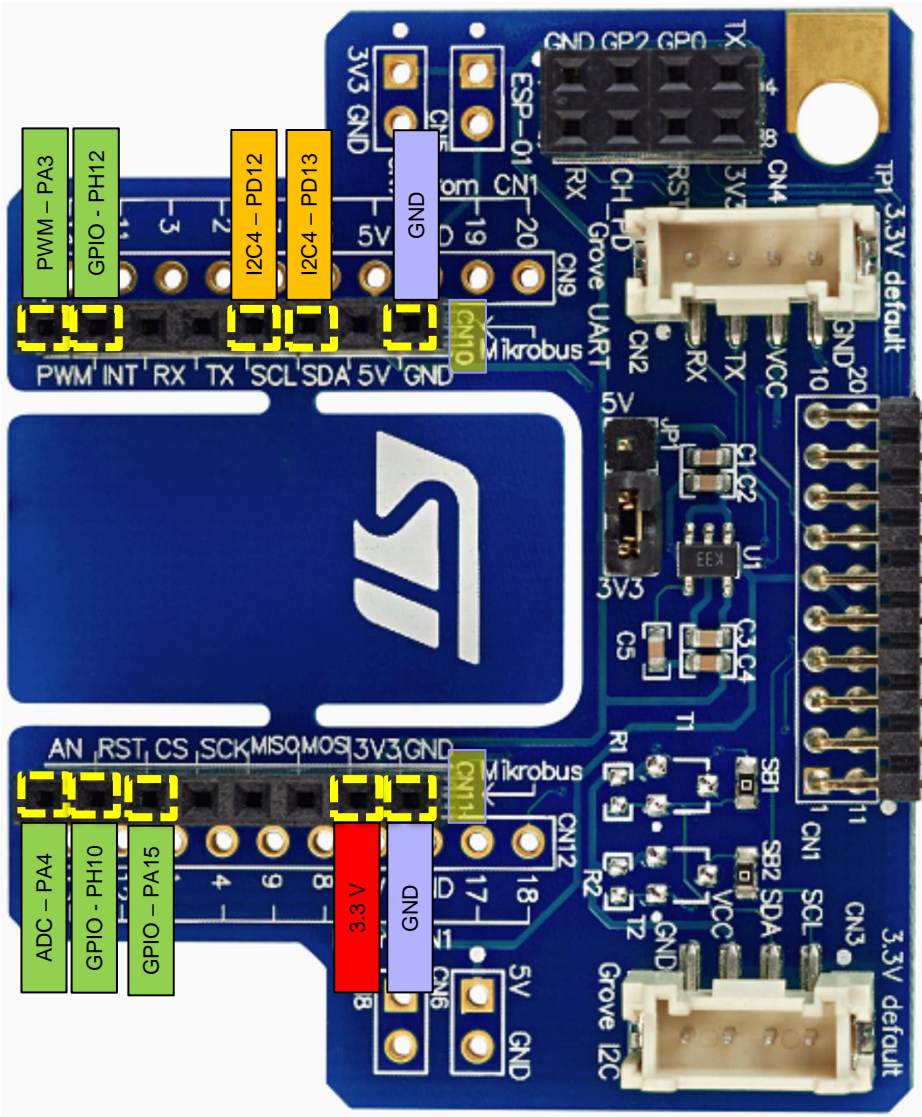
Nepravilna priključitev



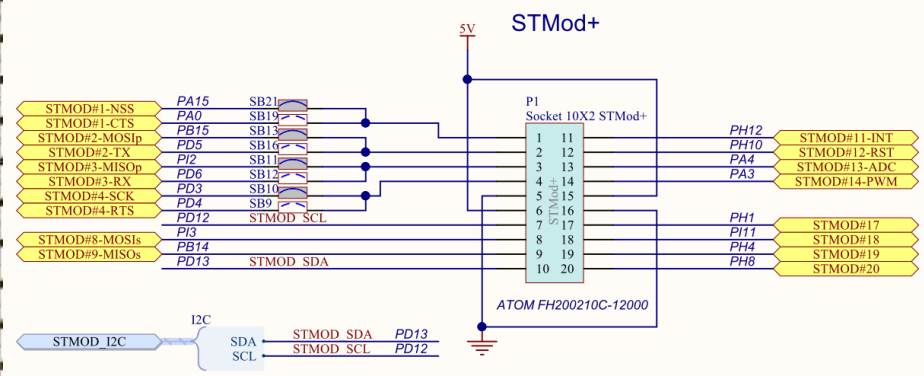
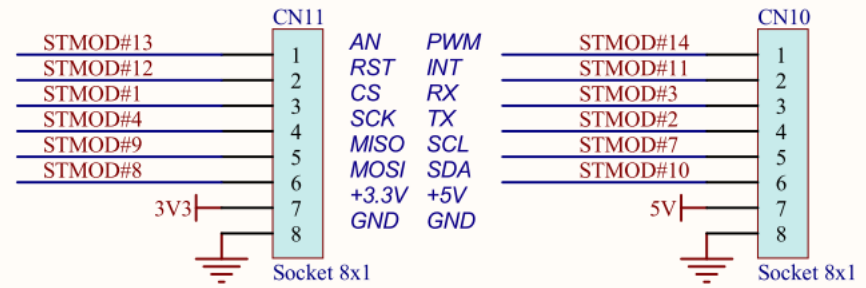
<https://www.st.com/en/evaluation-tools/stm32h750b-dk.html>

3.3V !!!

STM32H750B – DISCOVERY StMod+ konektor



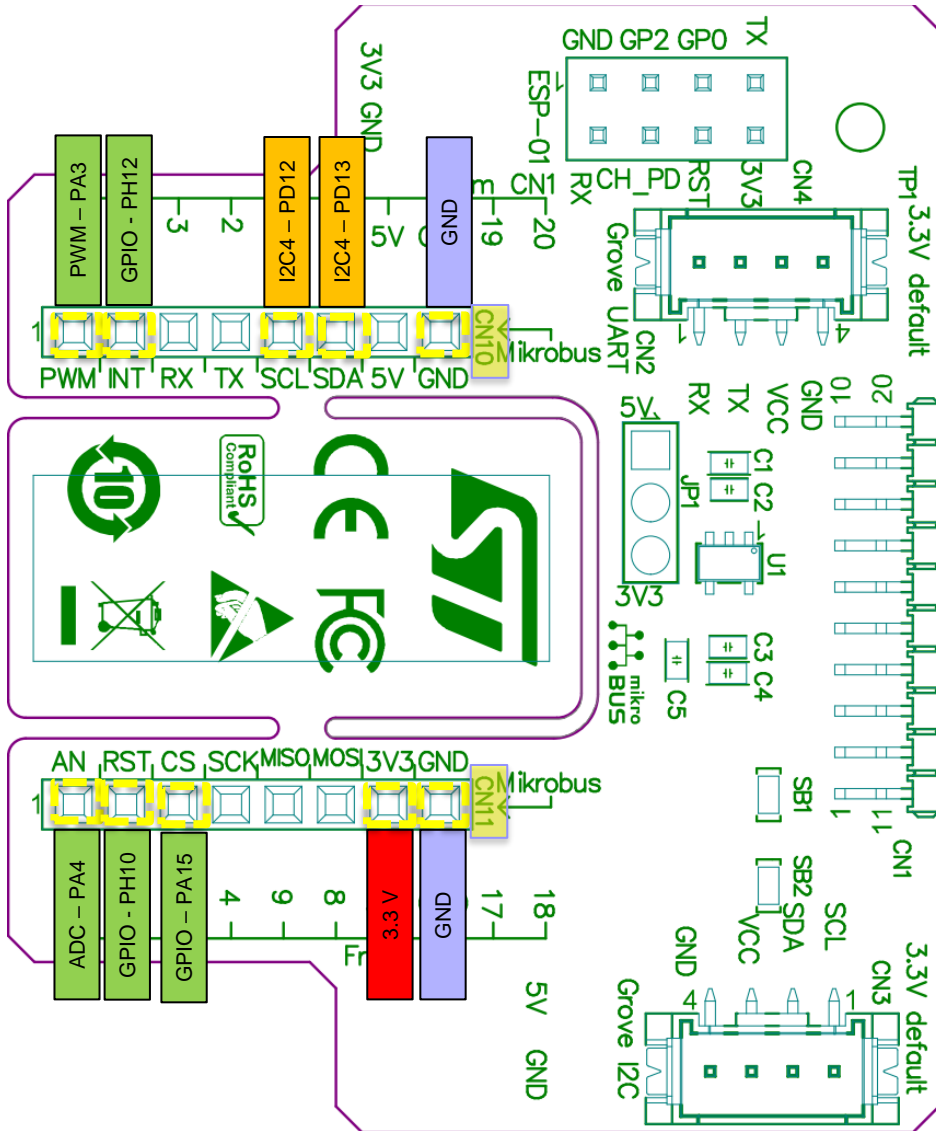
Mikrobus connectors



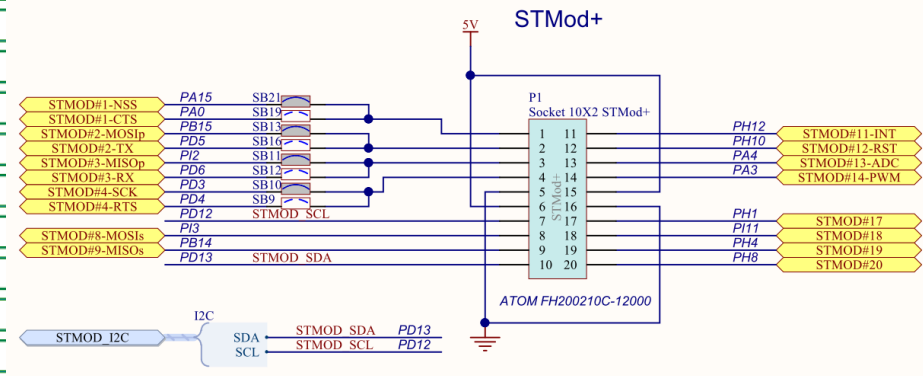
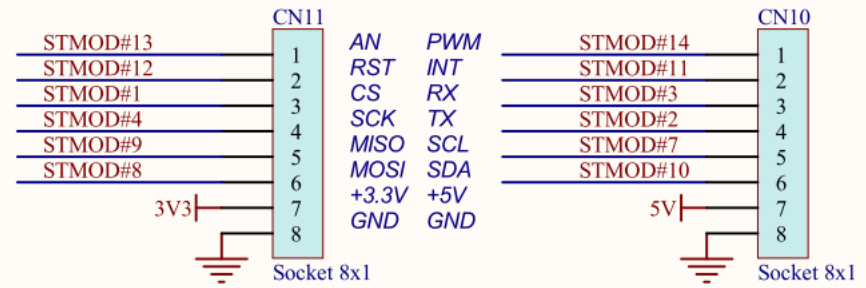
STM32H7

3.3V !!!

STM32H750B – DISCOVERY StMod+ konektor



Mikrobus connectors



STM32H7

STM32H750B – DISCOVERY

StMod+ konektor

3.3V !!!

STM32H750VB STM32H750ZB STM32H750IB STM32H750XB Electrical characteristics (rev Y)

- This formula has to be applied on power supplies related to the IO structure described by the pin definition table.
- To sustain a voltage higher than 4V the internal pull-up/pull-down resistors must be disabled.

Table 20. Current characteristics

Symbols	Ratings	Max	Unit
$\Sigma I_{V_{DD}}$	Total current into sum of all V_{DD} power lines (source) ⁽¹⁾	620	mA
$\Sigma I_{V_{SS}}$	Total current out of sum of all V_{SS} ground lines (sink) ⁽¹⁾	620	
$I_{V_{DD}}$	Maximum current into each V_{DD} power pin (source) ⁽¹⁾	100	
$I_{V_{SS}}$	Maximum current out of each V_{SS} ground pin (sink) ⁽¹⁾	100	
I_{IO}	Output current sunk by any I/O and control pin	20	
$\Sigma I_{(PIN)}$	Total output current sunk by sum of all I/Os and control pins ⁽²⁾	140	
	Total output current sourced by sum of all I/Os and control pins ⁽²⁾	140	
$I_{INJ(PIN)}$ ⁽³⁾⁽⁴⁾	Injected current on FT_xxx, TT_xx, RST and B pins except PA4, PA5	-5/+0	
	Injected current on PA4, PA5	-0/0	
$\Sigma I_{INJ(PIN)}$	Total injected current (sum of all I/Os and control pins) ⁽⁵⁾	±25	

Output driving current

The GPIOs (general purpose input/outputs) can sink or source up to ±8 mA, and sink or source up to ±20 mA (with a relaxed V_{OL}/V_{OH}).

In the user application, the number of I/O pins which can drive current must be limited to respect the absolute maximum rating specified in [Section 6.2](#). In particular:

Delo na STM32H7 razvojnem sistemu

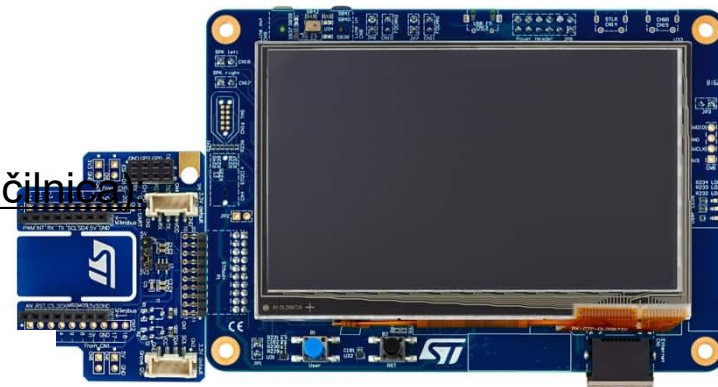
Mikro USB priključek na daljši stranici (srednji !!!) ↓

Priključitev :

- **Mikro USB** priključek na **daljši stranici (srednji !!!)**

Poseben začetni projekt (github) in info za STM32H7 (e-učilnice)

- **odajanje vsebine (main.c):**



```
CubelDEWorkspace - Sluzba/ORLab-STM32H7/STM32H750B-DK_C_Basic/Core/Src/main.c - STM32CubelDE
File Edit Source Refactor Navigate Search Project Run Window Help
Project Explorer ×
CubelDE_Workspace
Delo
Node_V4 (in node_v4)
Sluzba
  CAN_IEX_Module
  CAN_IEX_Module_bak
  H7-BSP-LCD-OS
  ORLab-STM32
  ORLab-STM32H7
    Docs
    DWT_Cycles_Measurements
    GPIO_LEDs
    STM32H750B-DK_C_Basic
      Core
        Inc
        Src
main.c
131
132  /* Infinite loop */
133  /* USER CODE BEGIN WHILE */
134  while (1)
135  {
136      HAL_GPIO_TogglePin(GPIOI, GPIO_PIN_13);
137      HAL_GPIO_TogglePin(GPIOJ, GPIO_PIN_2);
138
139      /* USER CODE END WHILE */
140
141      /* USER CODE BEGIN 3 */
142      snprintf (SendBuffer,BUFSIZE,"USART3:%d secs\r\n",Cnt);
143      HAL_UART_Transmit(&huart3,SendBuffer,strlen(SendBuffer),1);
144
145      HAL_Delay(1000);
146      Cnt++;
147  }
148  /* USER CODE END 3 */
149 }
150
```

----- Razvojni sistem STM32H750-DK -----

- STM32H750B-DK Discovery kit with STM32H750XB MCU
- VINLab-STM32H7 - GitHub repozitorij
- STM32H7-online training (tutorials from ST)
- ORLab-STM32H7 - GitHub repozitorij
- STM32H7 - Dokumentacija

Lastni viri :

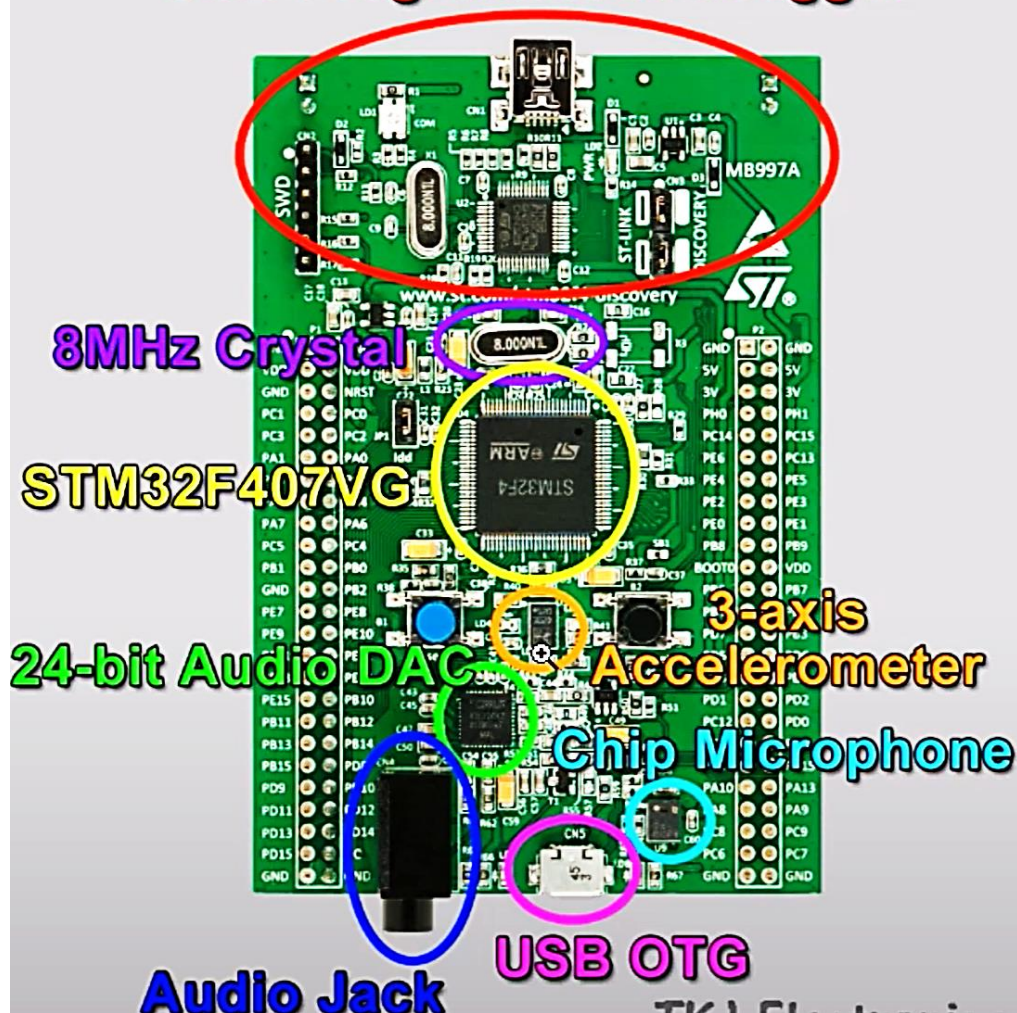
<https://github.com/LAPSyLAB/STM32H7> Discovery VIN Projects

<https://github.com/LAPSyLAB/ORLab-STM32H7>



STM32F4DISCOVERY USB Programmer/Debugger

3.3V !!!

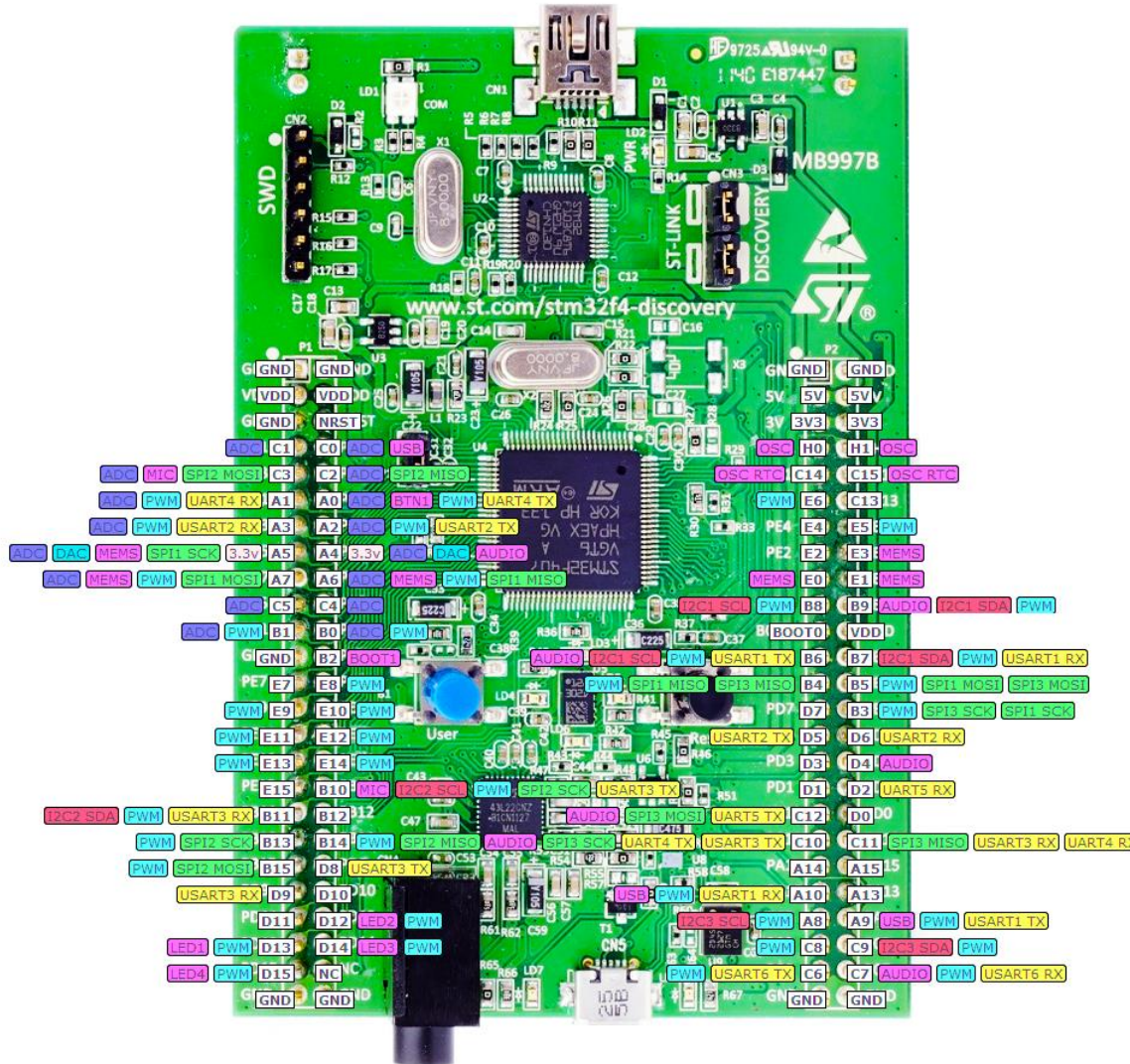


STM32F4DISCOVERY

3.3V !!!

P1

- 1 2
- 3 4
- 5 6
- 7 8
- 9 10
- 11 12
- 13 14
- 15 16
- 17 18
- 19 20
- 21 22
- 23 24
- 25 26
- 27 28
- 29 30
- 31 32
- 33 34
- 35 36
- 37 38
- 39 40
- 41 42
- 43 44
- 45 46
- 47 48
- 49 50



P2

- 1 2
- 3 4
- 5 6
- 7 8
- 9 10
- 11 12
- 13 14
- 15 16
- 17 18
- 19 20
- 21 22
- 23 24
- 25 26
- 27 28
- 29 30
- 31 32
- 33 34
- 35 36
- 37 38
- 39 40
- 41 42
- 43 44
- 45 46
- 47 48
- 49 50

Electrical characteristics

STM32F405xx, STM32F407xx

Table 11. Voltage characteristics

Symbol	Ratings	Min	Max	Unit
$V_{DD}-V_{SS}$	External main supply voltage (including V_{DDA} , V_{DD}) ⁽¹⁾	-0.3	4.0	V
V_{IN}	Input voltage on five-volt tolerant pin ⁽²⁾	$V_{SS}-0.3$	$V_{DD}+4$	
	Input voltage on any other pin	$V_{SS}-0.3$	4.0	
$ \Delta V_{DDx} $	Variations between different V_{DD} power pins	-	50	mV
$ V_{SSX} - V_{SS} $	Variations between all the different ground pins including V_{REF-}	-	50	
$V_{ESD(HBM)}$	Electrostatic discharge voltage (human body model)	see Section 5.3.14: Absolute maximum ratings (electrical sensitivity)		

Table 12. Current characteristics

Symbol	Ratings	Max.	Unit
I_{VDD}	Total current into V_{DD} power lines (source) ⁽¹⁾	240	mA
I_{VSS}	Total current out of V_{SS} ground lines (sink) ⁽¹⁾	240	
I_{IO}	Output current sunk by any I/O and control pin	25	
	Output current source by any I/Os and control pin	25	
$I_{INJ(PIN)}$ ⁽²⁾	Injected current on five-volt tolerant I/O ⁽³⁾	-5/+0	
	Injected current on any other pin ⁽⁴⁾	±5	
$\Sigma I_{INJ(PIN)}$ ⁽⁴⁾	Total injected current (sum of all I/O and control pins) ⁽⁵⁾	±25	

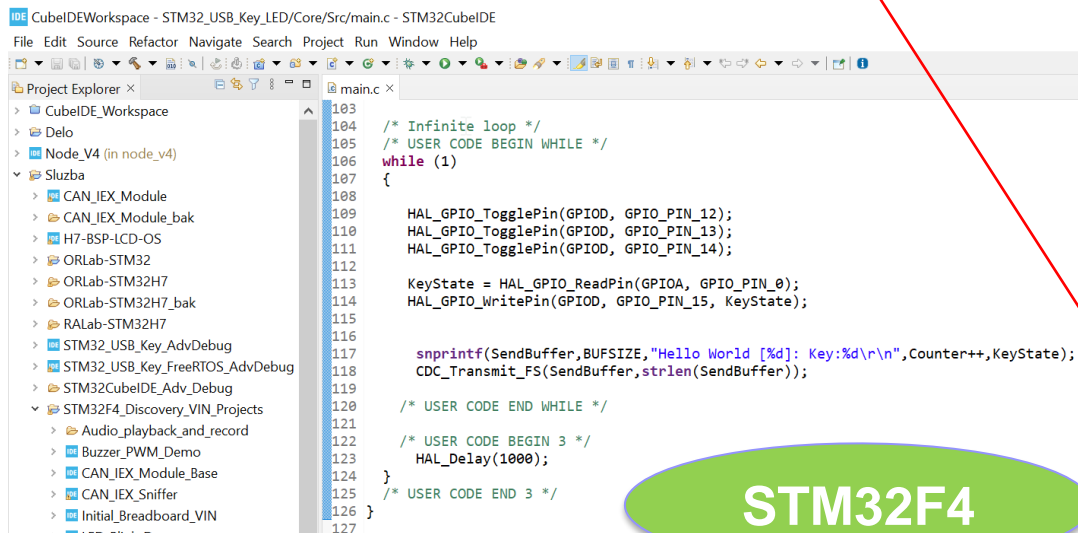
Delo na STM32F4 razvojnem sistemu

Priključitev :

- **Mini USB** prikllop na **krajši stranici**, svetila rdeči **LED** diodi

Poseben začetni projekt za STM32F4 (e-učilnica) :

- **dodajanje vsebine (main.c):**











```
103
104 /* Infinite loop */
105 /* USER CODE BEGIN WHILE */
106 while (1)
107 {
108
109     HAL_GPIO_TogglePin(GPIOA, GPIO_PIN_12);
110     HAL_GPIO_TogglePin(GPIOA, GPIO_PIN_13);
111     HAL_GPIO_TogglePin(GPIOA, GPIO_PIN_14);
112
113     KeyState = HAL_GPIO_ReadPin(GPIOA, GPIO_PIN_0);
114     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_15, KeyState);
115
116
117     snprintf(SendBuffer, BUFSIZE, "Hello World [%d]: Key:%d\r\n", Counter++, KeyState);
118     CDC_Transmit_FS(SendBuffer, strlen(SendBuffer));
119
120     /* USER CODE END WHILE */
121
122     /* USER CODE BEGIN 3 */
123     HAL_Delay(1000);
124 }
125 /* USER CODE END 3 */
126 }
127
```



**Mikro USB
VCom-port**

----- Razvojni sistem STM32F407 Discovery -----

-  STM32F4DISCOVERY Discovery kit with STM32F407VG MCU 
-  VINLab-STM32 - GitHub repozitorij 
-  ORLab-STM32 - GitHub repozitorij 
-  STM32F4 - Dokumentacija 

Lastni viri :

https://github.com/LAPSYLAB/STM32F4_Discovery_VIN_Projects

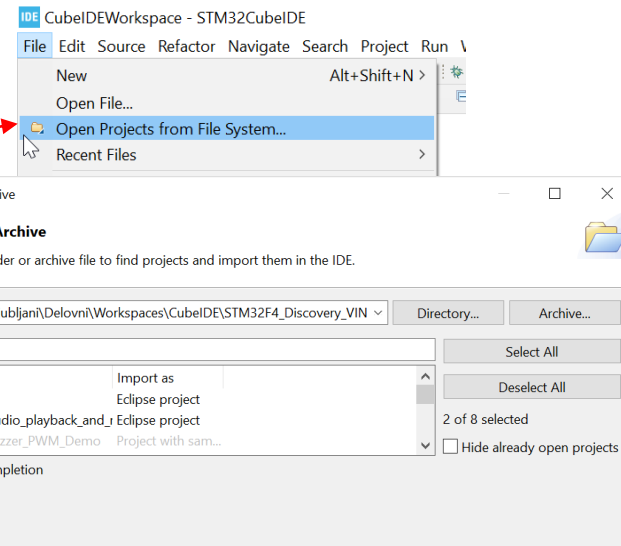
https://github.com/LAPSYLAB/STM32F4_Docs_and_Examples

<https://github.com/LAPSYLAB/ORLab-STM32>

Delo v CubeIDE

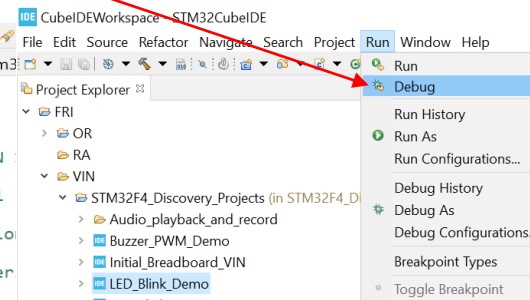
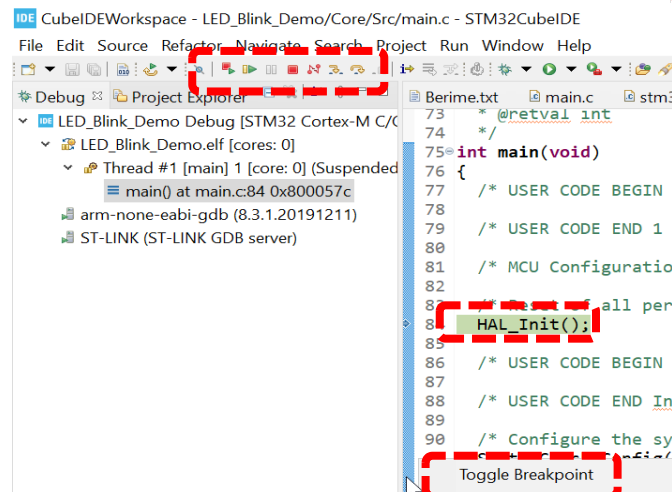
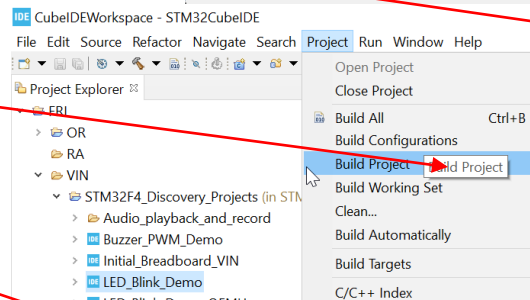
Vzpostavitev začetnega projekta :

- Uvoz obstoječega
 - Open projects from File System
 - Select project(s)
- Nov projekt Cube MX
- Kopiranje obstoječega



Prevajanje, zagon :

- Project -> Build Project
- Run -> Debug
- Step (Into, Over), Breakpoints



Navodila :

- CubeIDE asm projekt
 - 1) Edit > Copy.
 - 2) Edit > Paste.
 - 3) Delete the Debug launch file.
 - 4) Project > Clean.
 - 5) Project > Build Project.
 - 6) Debug As Stm32 Application.
 - 7) And debug the application
 - 8) Add breakpoint on first instruction if necessary
- CubeIDE projekt z CubeMX
 - 1) Edit > Copy.
 - 2) Edit > Paste.
 - 3) Rename the ioc files.
 - 4) Delete the Debug launch file.
 - 5) Project > Clean.
 - 6) Generate the CubeMX.
 - 7) Project > Build Project.
 - 8) Debug As Stm32 Application.
 - 9) And debug the application.

Skopiram, preimenujem, generiram ioc, clean in build

VIN projekt - VP5: STM32-CubeIDE projekt, breadboard vezave

- Osvežitev: STM32 sistema

- STM32H7
- STM32F4

- Priprava na povezovanje

- STM32 CubeIDE + Breadboard

- LED, tipka, potenciometer, uporovna tipala
 - STM32H7
 - STM32F4

- DN2-VP3: Breadboard + STM32

VIN / Gradiva za LAB delo (listine, navodila, ...)

MAPA
Gradiva za LAB delo (listine, navodila, ...)

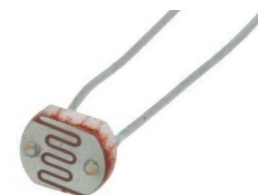
Mapa Nastavitve Več ▾

Uredi

- ▼
- ▼ Multimeter
 - Multimeter EMOS MD-420.pdf
- ▼ Uporovna_tipala
 - LDR_PGM5537.pdf
 - NTCC-2K2.pdf
 - TRIMPOT_TSR-3296Z.pdf

Uporovna tipala LDR – Light Dependent Resistor PGM5337

FOTO UPOR PGM5337 100mW 16-50kR 540nm



▶ Electronics Characteristics

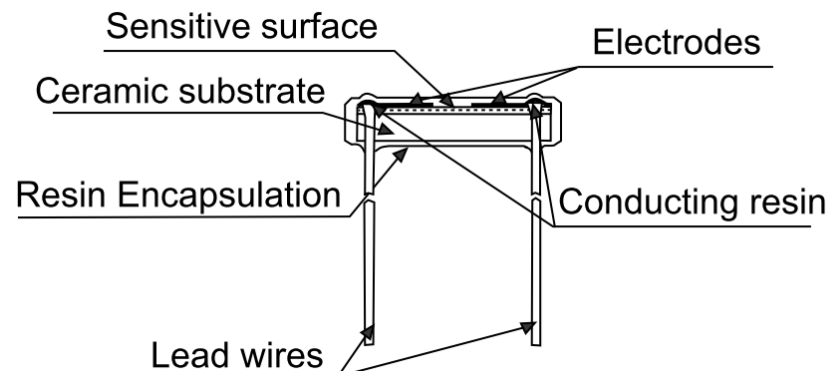
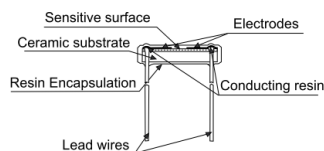
Model	Vmax (VDC)	Pmax (mW)	Ambient Temp (°C)	Spectral Peak (nm)	Photo Resistance (10Lx) (KΩ)	Dark Resistance (MΩ)min	γ _{min}	ResponseTime (ms)	
								Rise	Decay
PGM5506	100	90	-30 ~ +70	540	2 ~ 6	0.15	0.6	30	40
PGM5516	100	90	-30 ~ +70	540	5 ~ 10	0.2	0.6	30	40
PGM5526	150	100	-30 ~ +70	540	8 ~ 20	1.0	0.6	20	30
PGM5537	150	100	-30 ~ +70	540	16 ~ 50	2.0	0.7	20	30



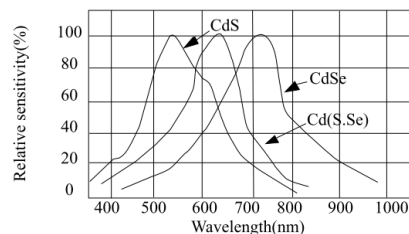
PGM CDS Photoresistors

▶ Terminology WIN projekt - VPS: STM32-Cub...

- **Light Resistance :**
Measured at 10 lux with standard light A (2854K-color temperature) and 2hr. preillumination at 400-600 lux prior testing.
- **Dark Resistance :**
Measured at 10th seconds after closing 10 lux.
- **Gamma characteristic :**
Under 10 lux and 100 lux and given by $\gamma = \log(R_{10}/R_{100}) / \log(100/10) = \log(R_{10}/R_{100})$
R10, R100: resistance at 10 lux and 100 lux.
The tolerance of γ is ± 0.1 .



- **Pmax :**
Max. power dissipation at ambient temperature of 25°C. At higher ambient temperature, the maximum power permissible may be lowered.
- **Vmax :**
Max. voltage in darkness that may be applied to the device continuously.
- **Spectral peak :**
Spectral sensitivity of photoresistors depends on the wavelength of light they are exposed to and in accordance with figure 'Spectral Response'.
The tolerance of spectral peak is ± 50 nm.





Uporovna tipala

NTC – Termistor NTCC-2K2

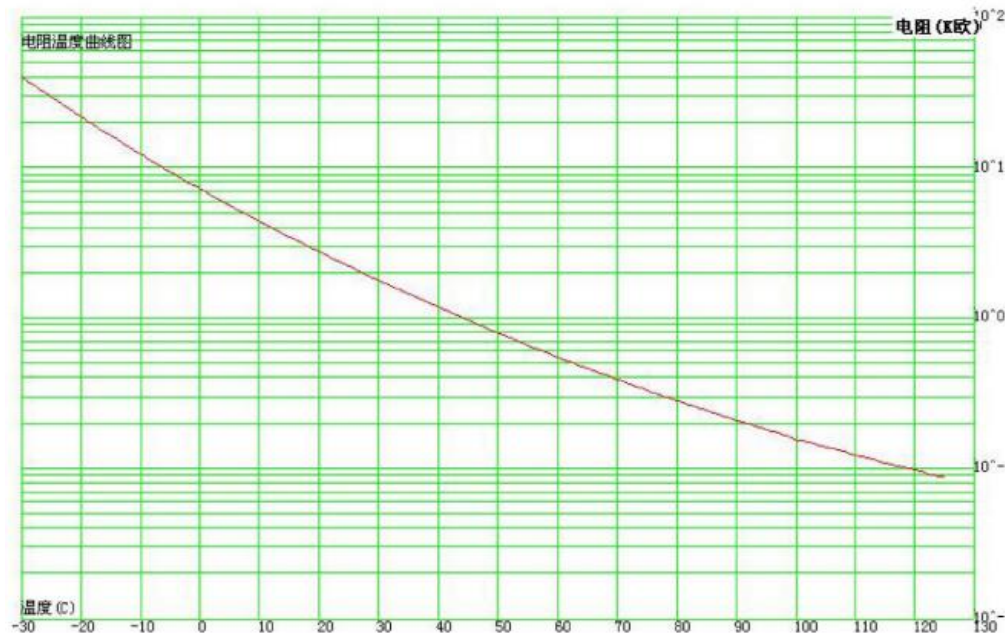
R25 = 2.2kΩ

B25/50 = 3950K

NTCC-2K2 SR PASSIVES

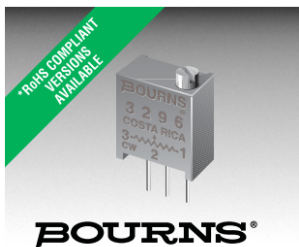
NTC thermistor; 2.2kΩ; THT; 3900K; -55 ÷ 125° C; 500mW; Ø6.5mm

T°C	R kΩ	T°C	R kΩ	T°C	R kΩ	T°C	R kΩ	T°C	R kΩ	T°C	R kΩ
-30	40.128	-4	8.871	22	2.511	48	0.857	74	0.341	100	0.154
-29	37.694	-3	8.415	23	2.402	49	0.824	75	0.33	101	0.154
-28	35.418	-2	7.986	24	2.298	50	0.794	76	0.319	102	0.15
-27	33.289	-1	7.581	25	2.2	51	0.764	77	0.309	103	0.146
-26	31.298	0	7.238	26	2.105	52	0.736	78	0.3	104	0.142
-25	29.436	1	6.839	27	2.016	53	0.709	79	0.29	105	0.139
-24	27.693	2	6.499	28	1.931	54	0.683	80	0.281	106	0.135
-23	26.064	3	6.179	29	1.85	55	0.659	81	0.273	107	0.132
-22	24.539	4	5.876	30	1.773	56	0.635	82	0.265	108	0.129
-21	23.112	5	5.59	31	1.699	57	0.612	83	0.257	109	0.125
-20	21.776	6	5.32	32	1.629	58	0.59	84	0.249	110	0.122
-19	20.526	7	5.064	33	1.562	59	0.57	85	0.242	111	0.12
-18	19.355	8	4.823	34	1.498	60	0.55	86	0.234	112	0.117
-17	18.258	9	4.594	35	1.437	61	0.53	87	0.228	113	0.114
-16	17.231	10	4.378	36	1.379	62	0.512	88	0.221	114	0.111
-15	16.267	11	4.173	37	1.324	63	0.494	89	0.215	115	0.109
-14	15.364	12	3.979	38	1.271	64	0.477	90	0.208	116	0.106
-13	14.517	13	3.795	39	1.221	65	0.461	91	0.202	117	0.104
-12	13.722	14	3.62	40	1.172	66	0.445	92	0.197	118	0.102
-11	12.976	15	3.455	41	1.126	67	0.43	93	0.191	119	0.099
-10	12.275	16	3.298	42	1.082	68	0.416	94	0.186	120	0.097
-9	11.617	17	3.15	43	1.04	69	0.402	95	0.181	121	0.095
-8	10.999	18	3.008	44	1	70	0.389	96	0.176	122	0.093
-7	10.417	19	2.874	45	0.962	71	0.376	97	0.171	123	0.091
-6	9.87	20	2.747	46	0.925	72	0.364	98	0.167	124	0.089
-5	9.356	21	2.626	47	0.89	73	0.352	99	0.162	125	0.088





Uporovna tipala TrimPot – Trimer Potenciometer TSR-3296Z-104



Features

- Multiturn / Cermet / Industrial / Sealed
- 5 terminal styles
- Tape and reel packaging available
- Chevron seal design
- Listed on the QPL for style RJ24 per MIL-R-22097 and RJ24 per High-Rel Mil-R-39035
- Mounting hardware available (H-117P)
- RoHS compliant* version available
- For trimmer applications/processing guidelines, [click here](#)

3296 - 3/8 " Square Trimpot® Trimming Potentiometer

Proizvajalec	Suntan
Številka proizvajalca	TSR-3296Z-104

Standard Resistance Table

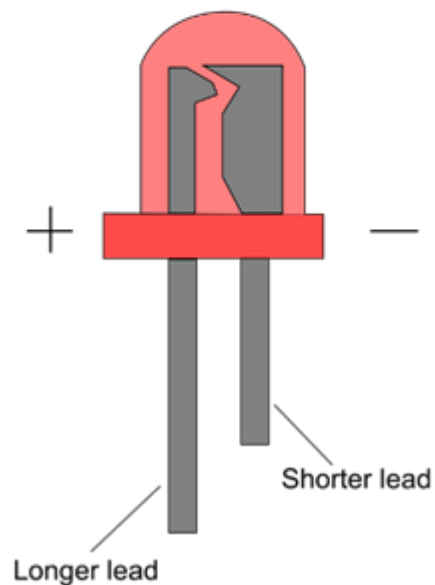
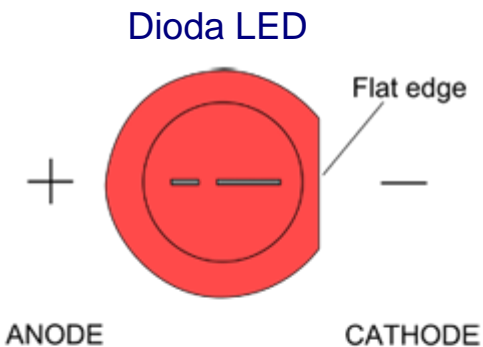
Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204

Proizvajalec	Suntan
Številka proizvajalca	TSR-3296Z-104
Upornost	100KOhm
Moč	0.5W
Toleranca	± 10%
Tip	THT

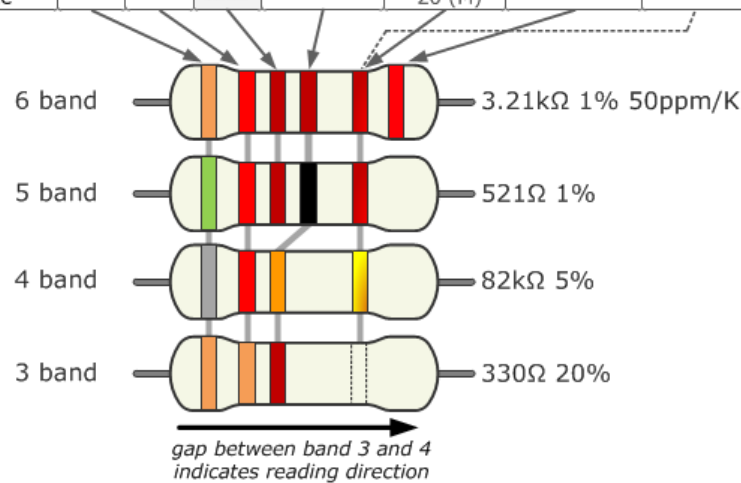


<https://www.ic-elect.si/trimpot-cer-64z-100k-tsr-3296z.html>

Elektronske komponente



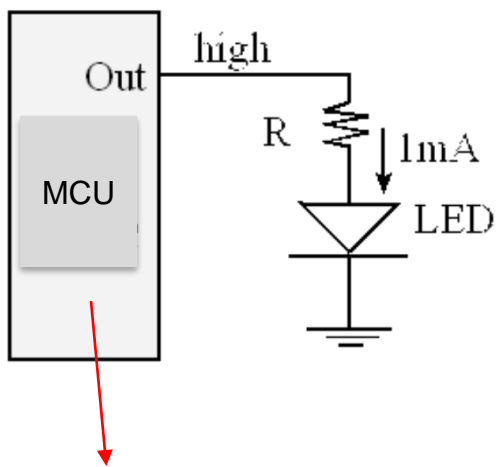
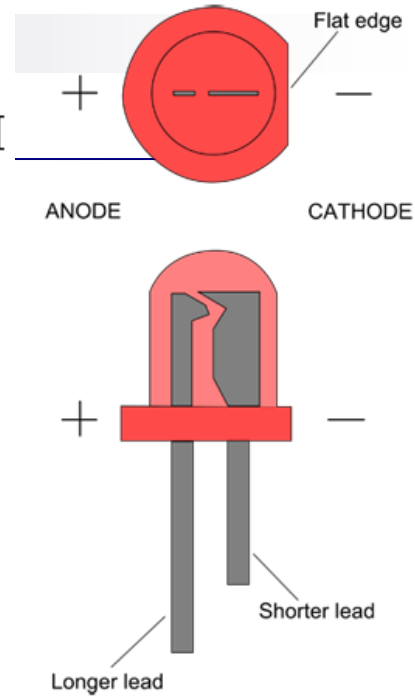
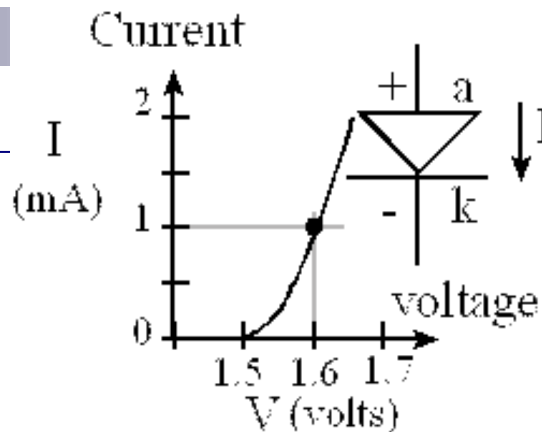
	Color	Significant figures			Multiply	Tolerance (%)	Temp. Coeff. (ppm/K)	Fail Rate (%)
Bad	black	0	0	0	x 1		250 (U)	
Beer	brown	1	1	1	x 10	1 (F)	100 (S)	1
Rots	red	2	2	2	x 100	2 (G)	50 (R)	0.1
Our	orange	3	3	3	x 1K		15 (P)	0.01
Young	yellow	4	4	4	x 10K		25 (Q)	0.001
Guts	green	5	5	5	x 100K	0.5 (D)	20 (Z)	
But	blue	6	6	6	x 1M	0.25 (C)	10 (Z)	
Vodka	violet	7	7	7	x 10M	0.1 (B)	5 (M)	
Goes	grey	8	8	8	x 100M	0.05 (A)	1(K)	
Well	white	9	9	9	x 1G			
Get	gold				x 0.1	5 (J)		
Some	silver				x 0.01	10 (K)		
Now!	none					20 (M)		



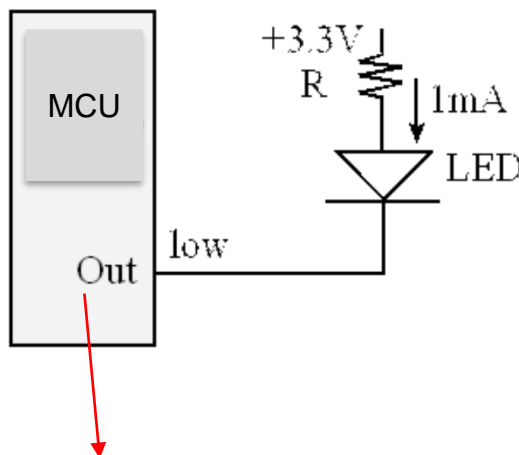
Resistor Color Code Calculator and Chart (4-band, 5-band or 6-band)

Z naslova <<https://www.allaboutcircuits.com/tools/resistor-color-code-calculator/>>

Dioda LED
Izračun upora za omejitev toka skozi tokom



$$R = \frac{V_{OH} - V_d}{I_d} = \frac{2.4 - 1.6}{0.001} = 800 \Omega$$



$$R = \frac{3.3 - V_d - V_{OL}}{I_d} = \frac{3.3 - 1.6 - 0.4}{0.001} = 1.3 \text{ k}\Omega$$

Z naslova <http://users.ece.utexas.edu/~valvano/Volume1/E-Book/C8_SwitchLED.htm>

Multimeter EMOS MD-420

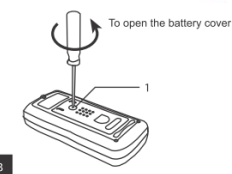
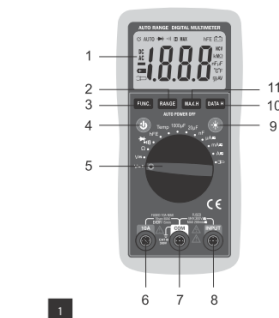


Preverjanje povezav

Merjenje upornosti

Merjenje el. napetosti

- enosmerna DC
- vzporedna** vezava !!!
- visoka** upornost



Merjenje el. toka

- zaporedna** vezava !!!
- nizka** upornost

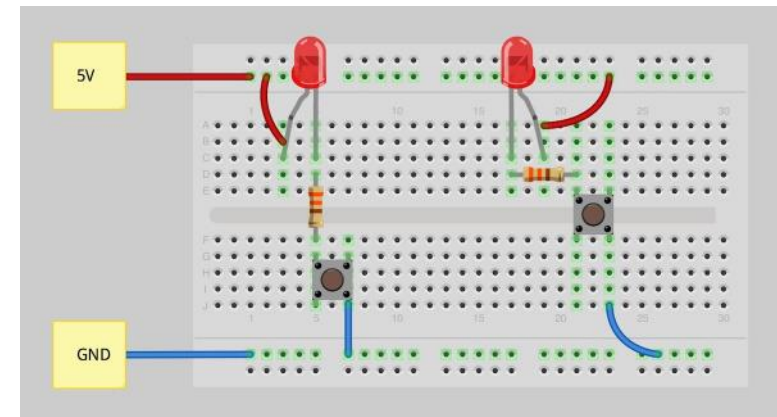
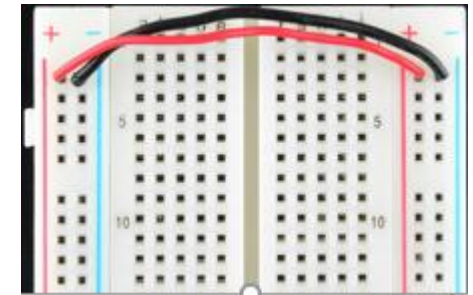
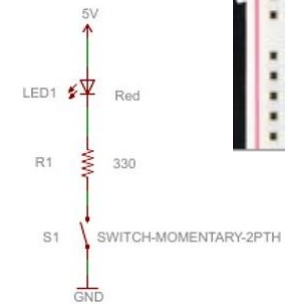
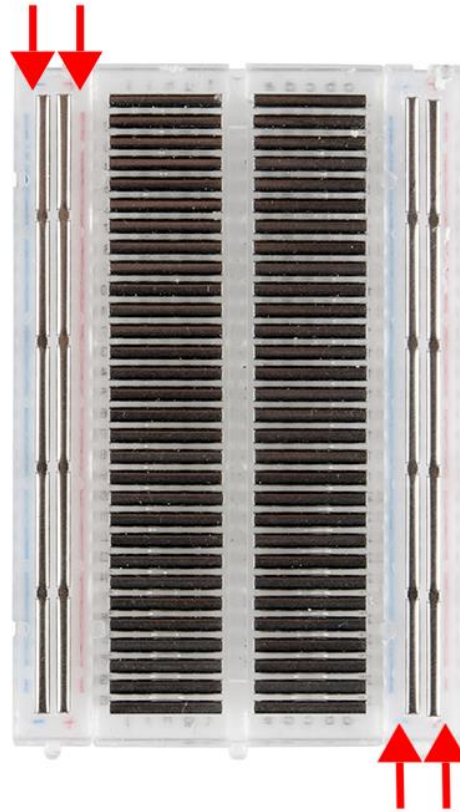
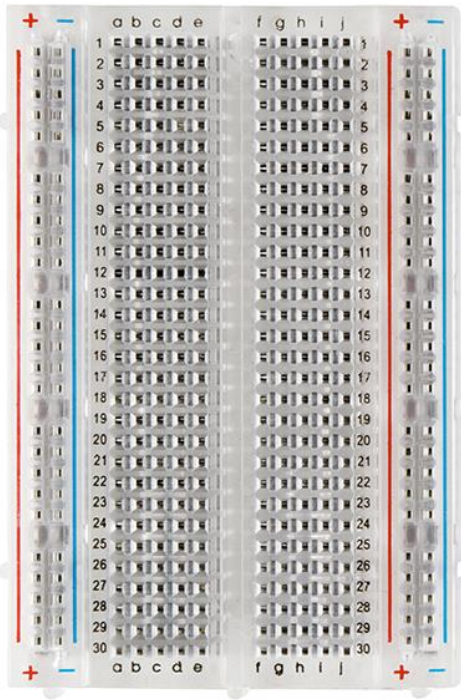
Praktični nasveti :

- Večinoma merimo napetost, upornost
- upornost samo izven tokokroga**
- pazimo, da ne sklenemo kratkega stika z merilno sondo (merjenje el. toka)**
- pazimo predvsem na majhne upornosti:**
 - Med +V in GND
 - Na izhodih, vhodih mikrokrmilnikov

<https://www.emos-si.si/multimeter-md-420>

VIN projekt : TinkerCad

Breadboard vezave

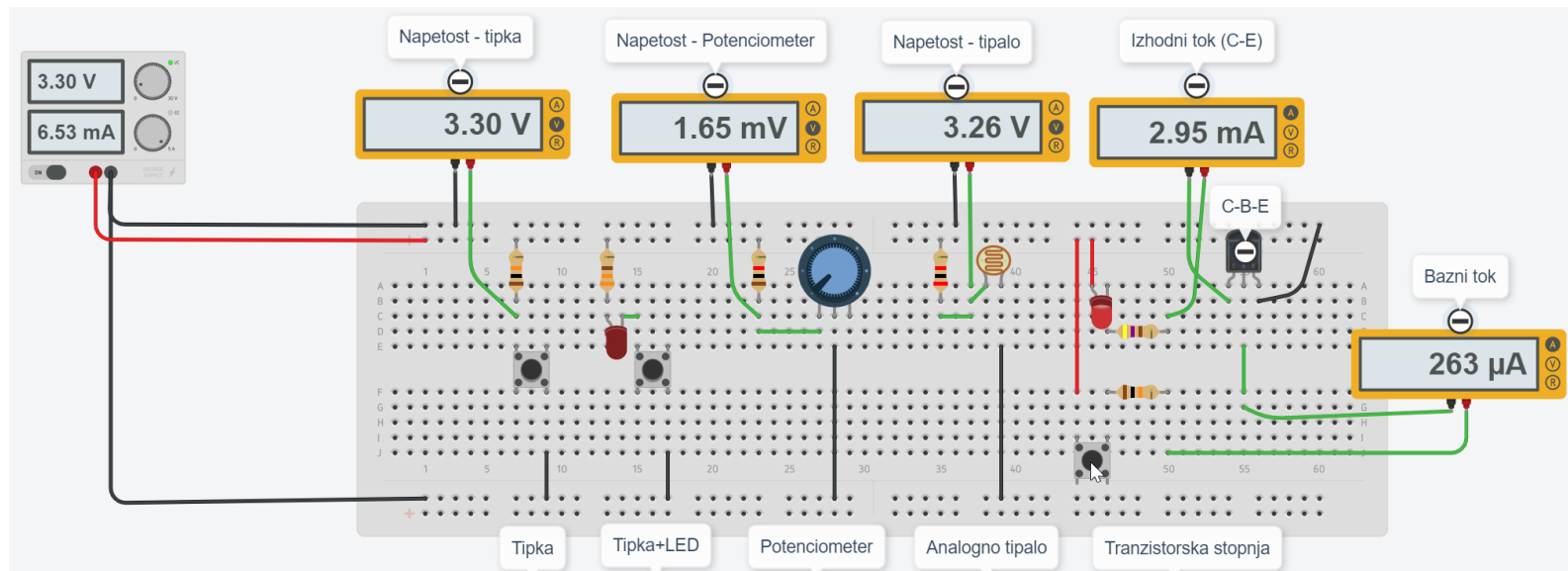
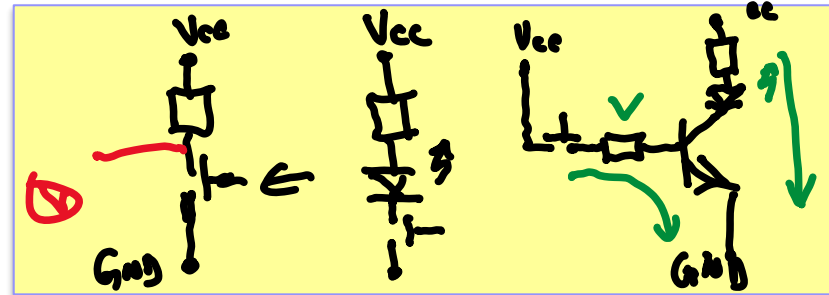


Viri

- <https://learn.sparkfun.com/tutorials/how-to-use-a-breadboard/>
- <https://www.sciencebuddies.org/science-fair-projects/references/how-to-use-a-breadboard>

VIN projekt : TinkerCad – LAB 2

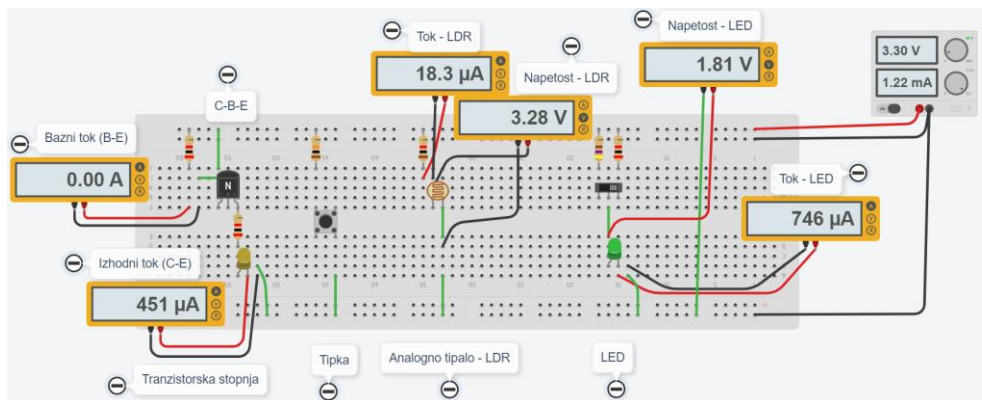
Breadboard vezave – VP2 primeri vezav



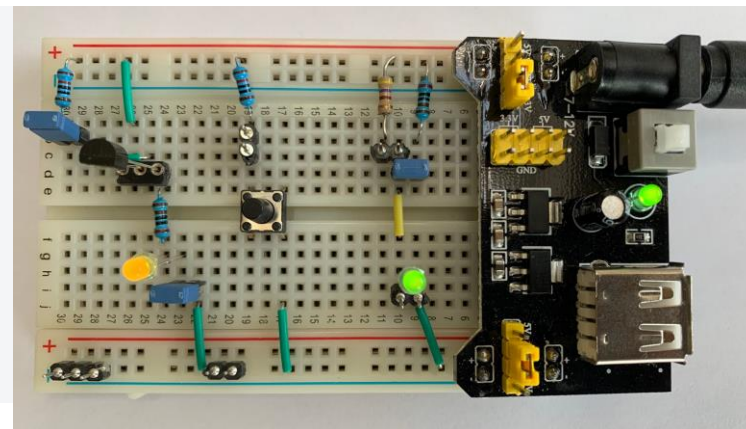
<https://www.tinkercad.com/things/9o9pEq418de>

Breadboard vezave – izhodišči za delo :

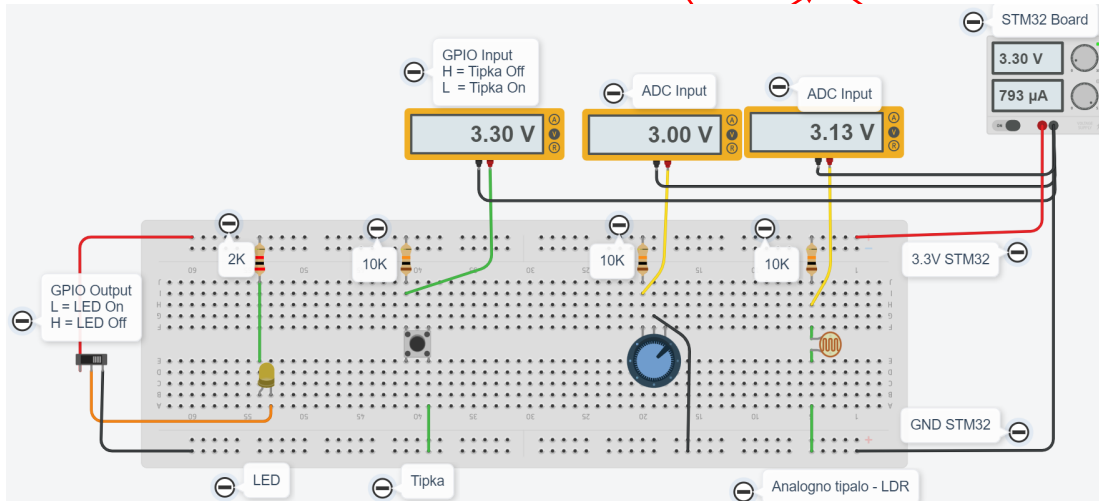
- „VIN LAB Breadboard Demo“ : demo breadboard „merilna“ (napajana) vezava (za meritve, poskuse, ...)



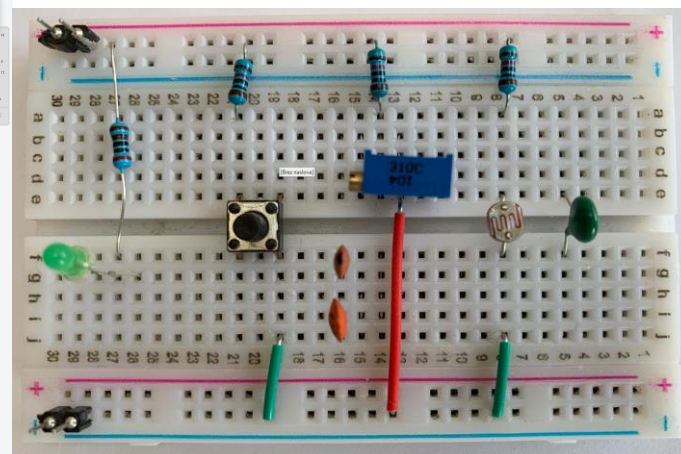
<https://www.tinkercad.com/things/1UQpxVO5DSY>



- „VIN LAB Breadboard STM32 IO Demo“ : demo breadboard vezava za povezavo s STM32 sistemoma

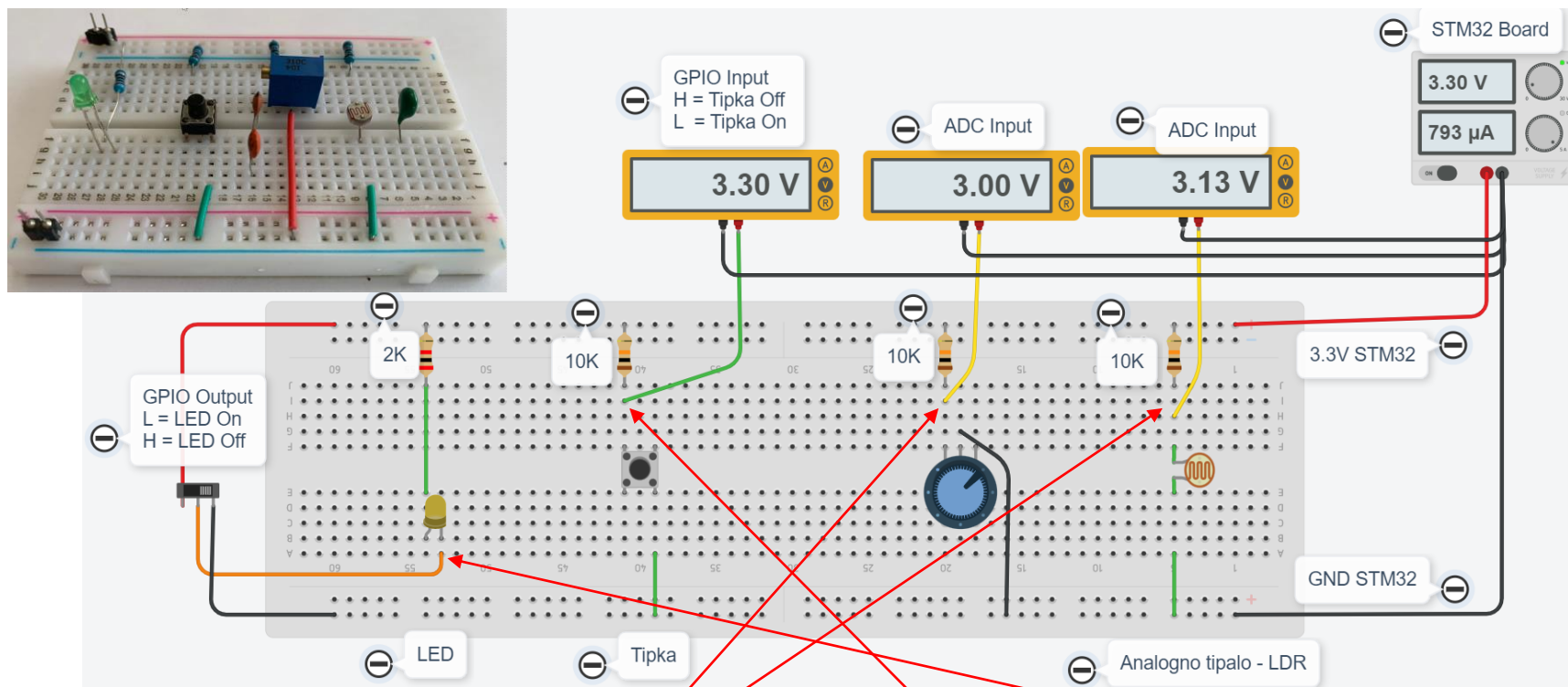


<https://www.tinkercad.com/things/cZld7zNU6Yd>

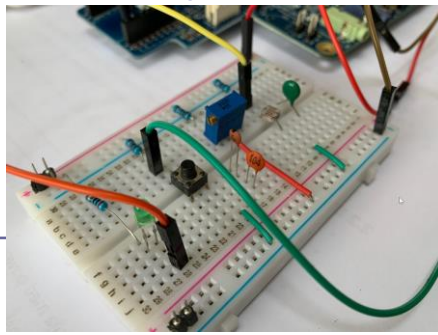
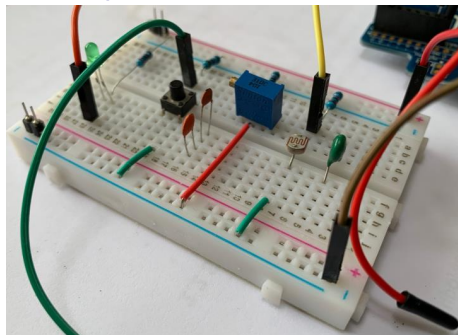


Breadboard vezava

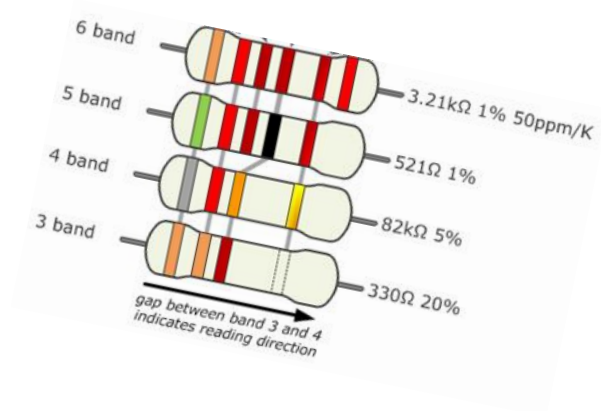
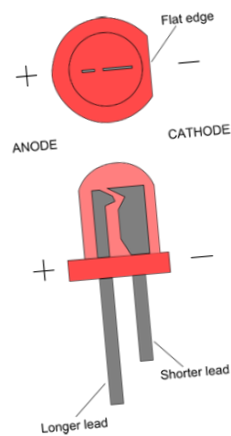
- „VIN LAB Breadboard STM32 IO Demo“ : demo breadboard vezava za povezavo s STM32 sistemoma



Priključitev na STM32 : ADC: 1x analogni, GPIO: 1x digitalni vhod (GPIO), 1x digitalni izhod



Breadboard vezava - pripomočki



Osnovna priporočila za potek praktičnega dela vaje :

- ❑ **z multimetri najprej preverite**
 - ❑ „napajano“ vezavo - „VIN LAB Breadboard Demo“ (po želji)
 - ❑ vezavo - „VIN LAB Breadboard STM32 IO Demo“

- ❑ **1. Vezava na breadboardu:**
 - ❑ v dvoje **izvedite lastno vezavo** (GPIO: tipka, led, ADC: uporovno tipalo)
 - ❑ previdno priključujte žice, konektorje

- ❑ **2. Preveritev vezav (multimeter, ...):**
 - ❑ **z multimetri še brez povezave s STM32 sistemom**
 - ❑ preverite posamezne komponente pred vezavo (upornosti, ...)
 - ❑ po vezavi: posamezne veje, stike, povezave, upornosti med Vcc in GND
 - ❑ **preverite logiko in pravilnost povezav**
 - ❑ preverite tudi slike povezanih sistemov

- ❑ **3. Povezava s STM32 in programiranje:**
 - ❑ **povežite s STM32 sistemom** (naj bo izkopljen)
 - ❑ **STM32: vklop in delo na STM32 programu**

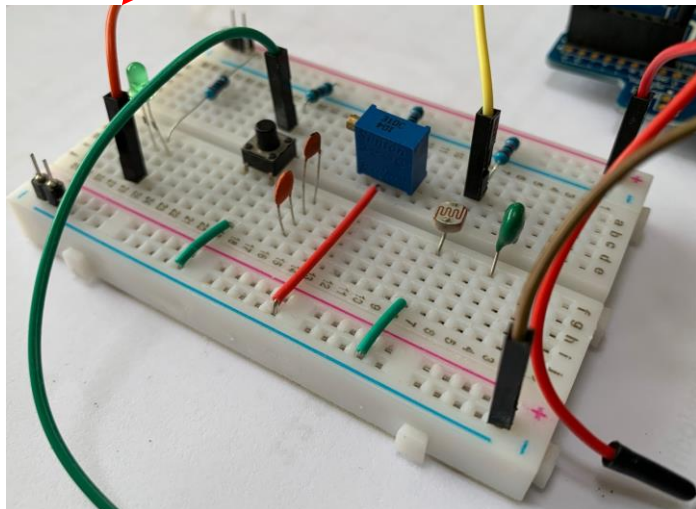
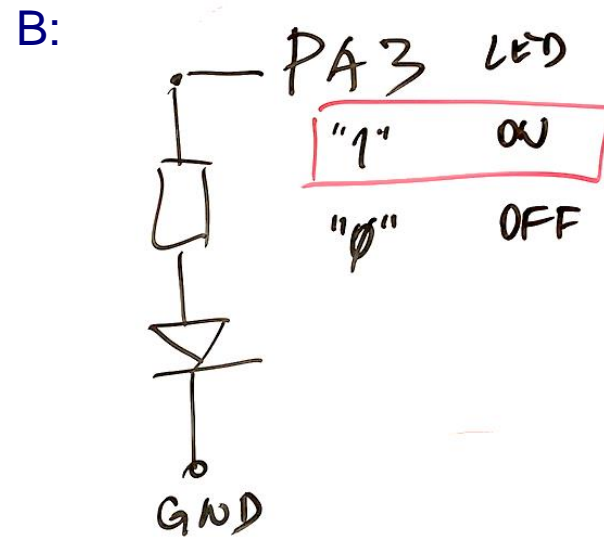
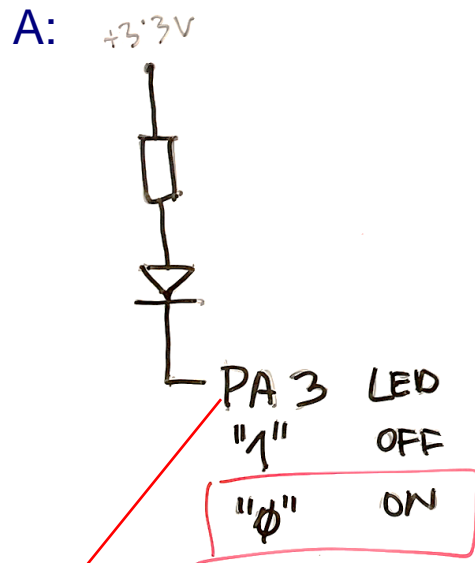
Napajanje 3V !!!
Priključite nazadnje !

VIN projekt - VP5: STM32-CubeIDE projekt, breadboard vezave

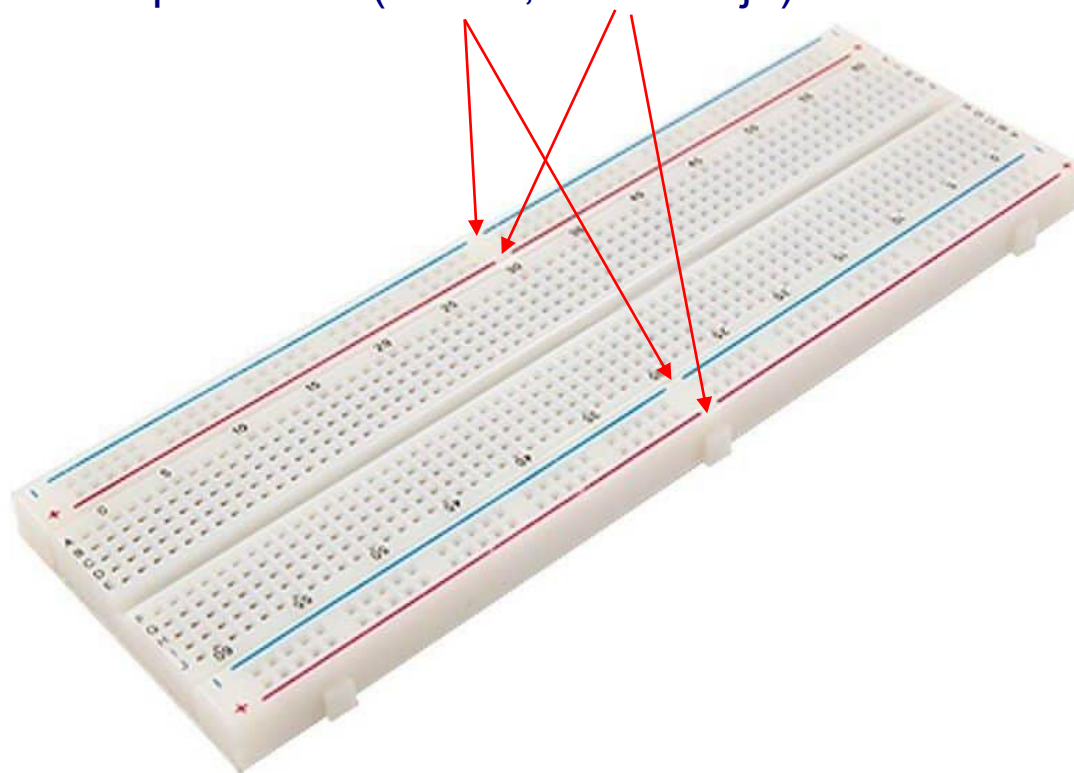
- Osvežitev: STM32 sistema
 - STM32H7
 - STM32F4
- Priprava na povezovanje

- STM32 CubeIDE + Breadboard
 - LED, tipka, potenciometer, uporovna tipala
 - STM32H7
 - STM32F4

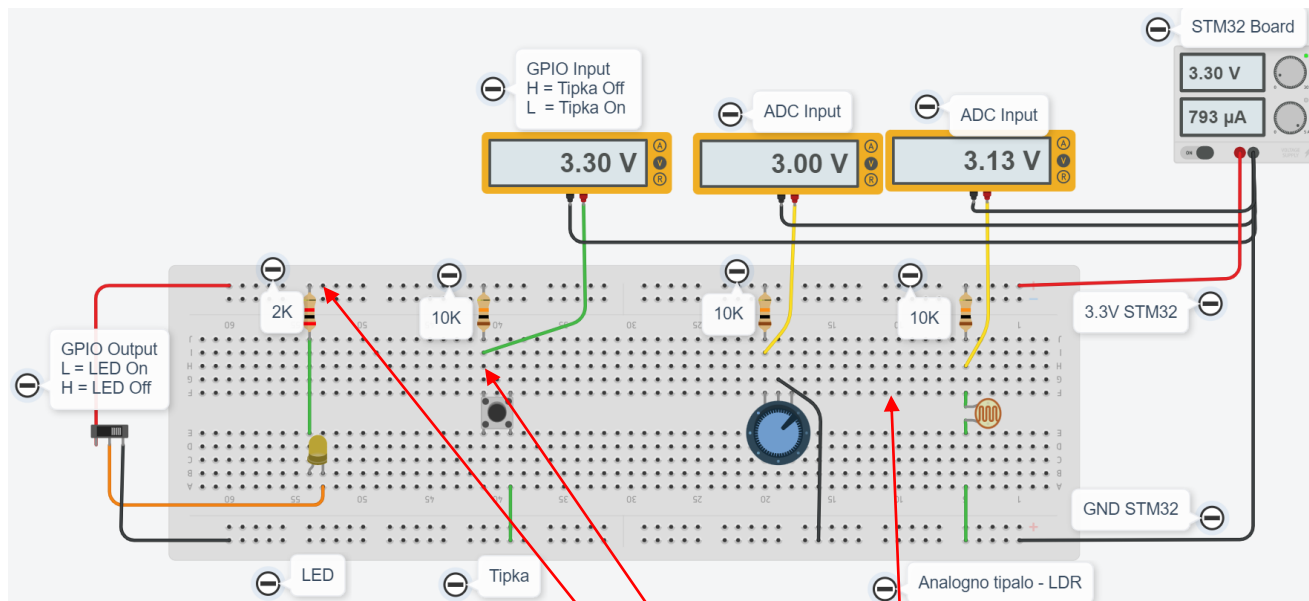
- DN2-VP3: Breadboard + STM32



Možna prekinitvev povezave (modra, rdeča linija)



Izhodišče : VIN LAB Breadboard STM32H7 IO Demo



Priključitev na STM32 : 1x analogni, 1x digitalni vhod, 1x digitalni izhod, 4x vgrajene LED diode

Testno vezje (primer) - STM32H7 :

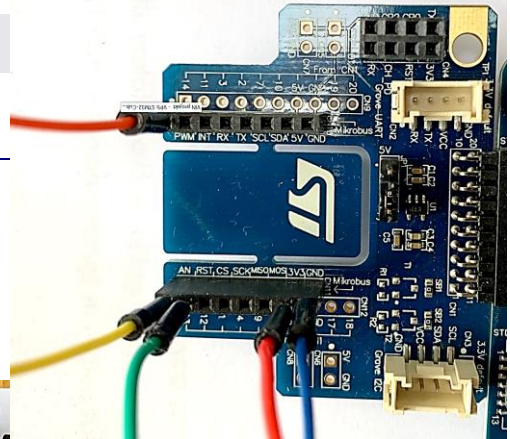
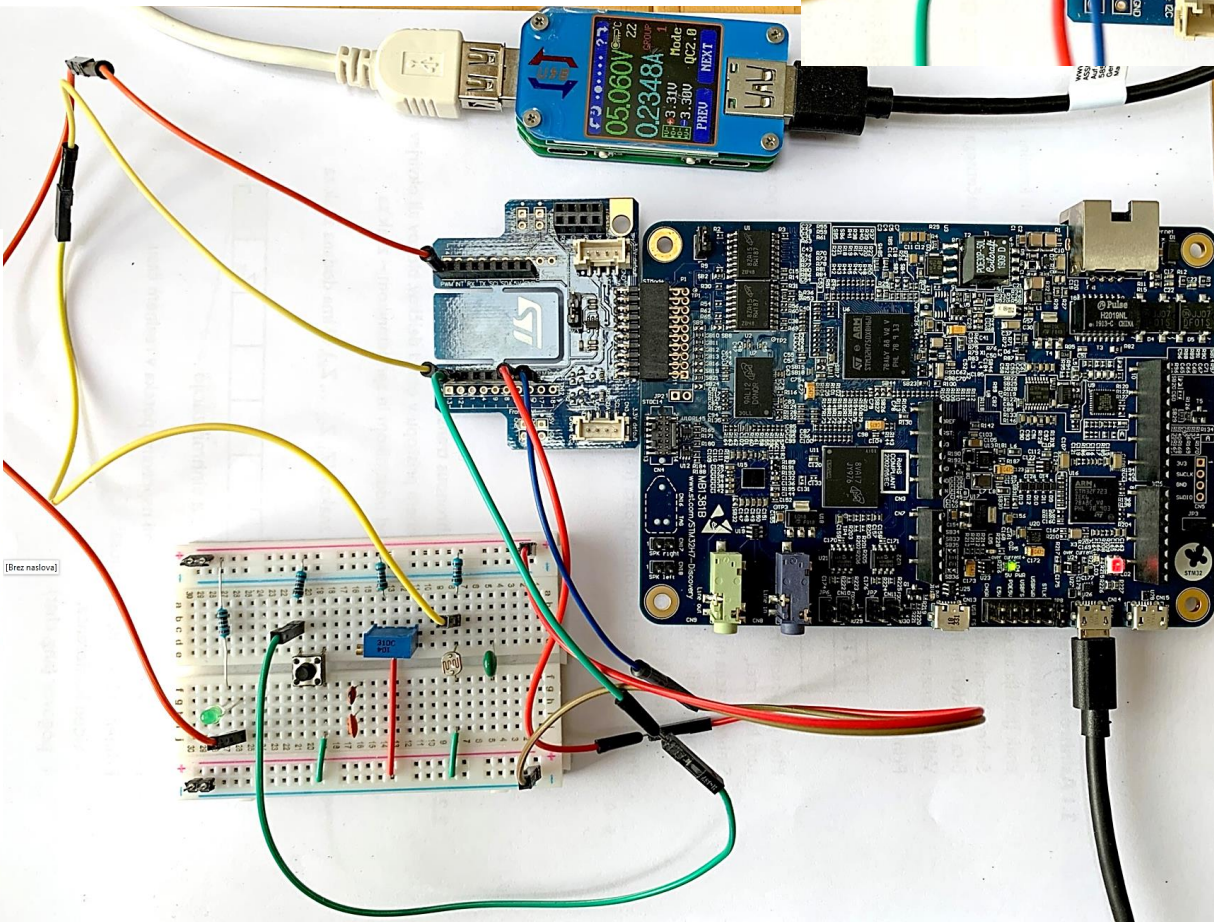
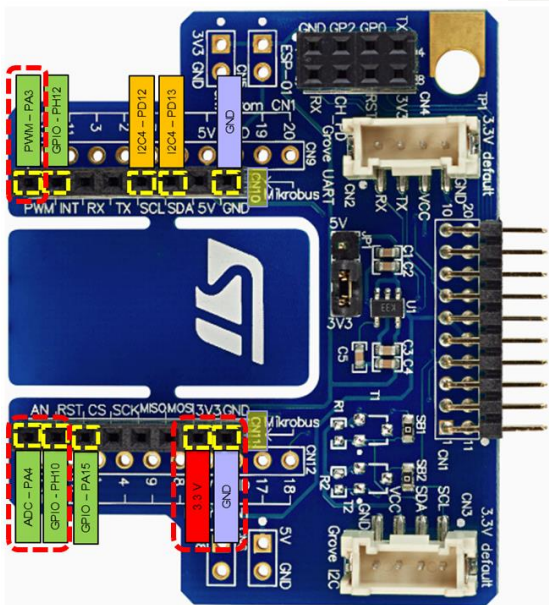
GPIO	Vrsta	Povezava
PC13	User tipka	Modra tipka
PA4	Analogni vhod	Rumena žička
PH10	Dig. Vhod	Zelena žička
PA3	Dig. Izhod - LED	Oranžna žička
PJ2, Pi13	Dig. Izhodi	vgr. LED diode

STM32H7

Priključitev na STM32 : 1x analogni, 1x digitalni vhod, 1x digitalni izhod

Testno vezje (primer) - STM32H7 :

GPIO	Vrsta	Povezava
PC13	User tipka	Modra tipka
PA4	Analogni vhod	Rumena žička
PH10	Dig. Vhod	Zelena žička
PA3	Dig. Izhod - LED	Oranžna žička
PJ2,PI13	Dig. Izhodi	vgr. LED diode



Konfiguracija 2: (PB5 DIG_OUT, PB4 DIG_INP, PA1 ADC1_IN1)

The screenshot shows the 'Pinout & Configuration' window for an STM32H7. The 'ADC1 Mode and Configuration' section is active. Under the 'Mode' tab, several channels are listed: IN9, IN10 (Disable), IN11 (Disable), IN12 (Disable), IN13 (Single-ended), IN14 (Single-ended), IN15 (Single-ended), IN16 (Disable), IN17, IN18 (IN18 Single-ended), and IN19. The 'Configuration' section shows 'Reset Configuration' and various settings tabs: NVIC Settings, DMA Settings, GPIO Settings, Parameter Settings, and User Constants. A table at the bottom lists the configured pins:

Pin Name	Signal on Pin	Pin Cont...	GPIO ou...	GPIO n...
PA1_C	ADC1_INP1;ADC2_INP1	n/a	n/a	Analog
PA4	ADC1_INP18	n/a	n/a	Analog

PA4

- Reset_State
- ADC1_INP18
- ADC2_INP18
- DAC1_OUT1
- DCMI_HSYNC
- I2S1_WS
- I2S3_WS
- LTDC_VSYNC
- SPI1_NSS
- SPI3_NSS
- SPI6_NSS
- TIM5_ETR
- USART2_CK
- USB_OTG_HS_SOF
- GPIO_Input
- GPIO_Output
- GPIO_Analog
- EVENTOUT
- GPIO_EXTI4

PA3

- Reset_State
- ADC1_INP15
- ADC2_INP15
- ETH_COL
- LPTIM5_OUT
- LTDC_B2
- LTDC_B5
- TIM15_CH2
- TIM2_CH4
- TIM5_CH4
- USART2_RX
- USB_OTG_HS_ULPI_D0
- GPIO_Input
- GPIO_Output
- GPIO_Analog
- EVENTOUT
- GPIO_EXTI3

Testno vezje (primer) - STM32H7 :

GPIO	Vrsta	Povezava
PC13	User tipka	Modra tipka
PA4	Analogni vhod	Rumena žička
PH10	Dig. Vhod	Zelena žička
PA3	Dig. Izhod - LED	Oranžna žička
PJ2,PI13	Dig. Izhodi	vgr. LED diode

PH10

- Reset_State
- DCMI_D1
- FMC_D18
- I2C4_SMBA
- LTDC_R4
- TIM5_CH1
- GPIO_Input
- GPIO_Output
- GPIO_Analog
- EVENTOUT
- GPIO_EXTI10

VIN projekt - VP 5 STM32-CubeIDE projekt, breadboard vezave

Program : za branje tipal in pošiljanje po USB Virtual COM Port

```

/* Infinite loop */
/* USER CODE BEGIN WHILE */
while (1)
{
  HAL_GPIO_TogglePin(GPIOI, GPIO_PIN_13);

  HAL_ADC_Start(&hadc1);
  HAL_ADC_PollForConversion(&hadc1, HAL_MAX_DELAY);
  AnalogValue = HAL_ADC_GetValue(&hadc1); // Read ADC value on analog input

  KeyState = HAL_GPIO_ReadPin(GPIOH, GPIO_PIN_10); // Read state of PH10
  HAL_GPIO_WritePin(GPIOA, GPIO_PIN_3, KeyState); // Write to PA3 accordingly

  snprintf(SendBuffer, BUFSIZE, "Hello World [%d]: Key:%d | ADC:%d\n\r", Counter++, KeyState, AnalogValue);
  HAL_UART_Transmit(&huart3, SendBuffer, strlen(SendBuffer), 100);

  HAL_Delay(1000);
/* USER CODE END WHILE */

/* USER CODE BEGIN 3 */

}
/* USER CODE END 3 */

```

```

/* USER CODE BEGIN PV */
#define BUFSIZE 256
char SendBuffer[BUFSIZE];
int Counter;
int KeyState=0;
int AnalogValue;

/* USER CODE END PV */

```

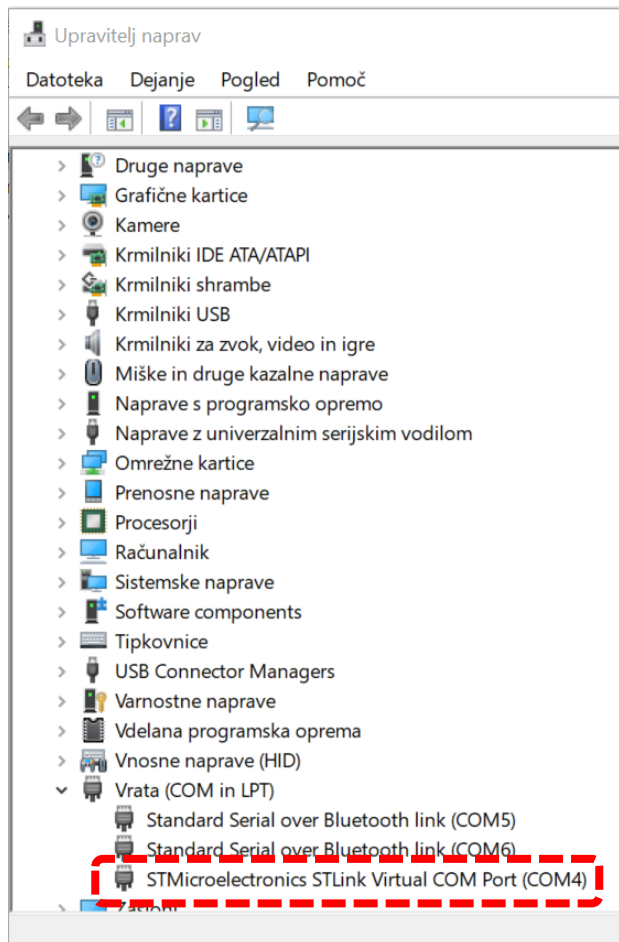
Testno vezje (primer) - STM32H7 :

GPIO	Vrsta	Povezava
PC13	User tipka	Modra tipka
PA4	Analogni vhod	Rumena žička
PH10	Dig. Vhod	Zelena žička
PA3	Dig. Izhod - LED	Oranžna žička
PJ2, Pi13	Dig. Izhodi	vgr. LED diode

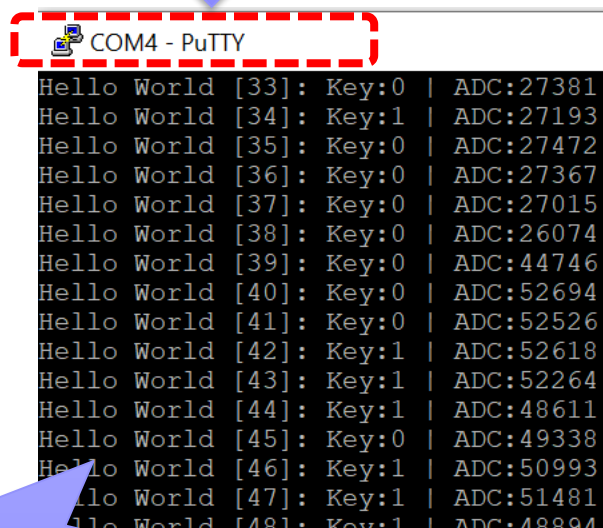
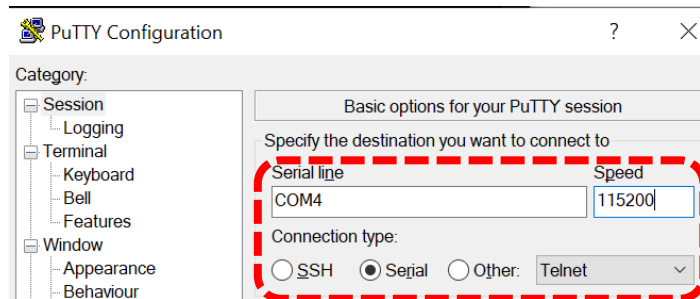
https://github.com/LAPSYLAB/STM32H7_Discovery_VIN_Projects/tree/main/STM32H750B-DK_Breadboard_VIN

Osnovni projekt CubeIDE – USB Virtual COM Port (USART3 na STM strani)

Program : sprejem na PC strani (povezava že vzpostavljena z Micro-USB kablom)



<https://the.earth.li/~sgtatham/putty/latest/w64/putty.exe>



Test serial
comm.

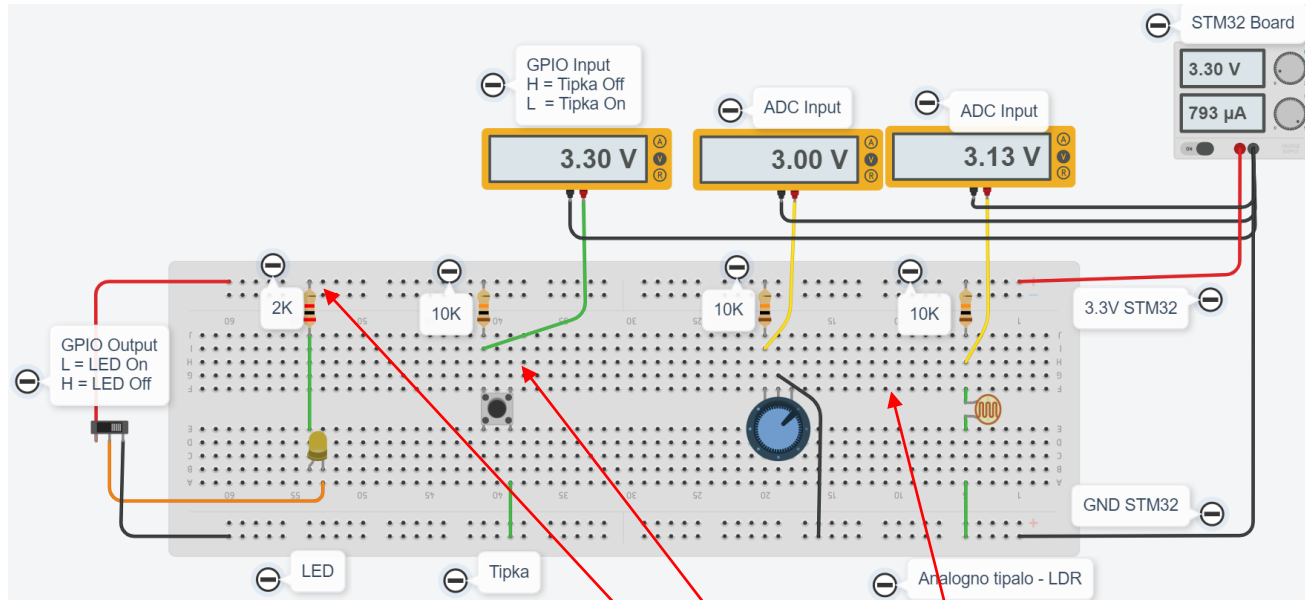
VIN projekt - VP5: STM32-CubeIDE projekt, breadboard vezave

- Osvežitev: STM32 sistema
 - STM32H7
 - STM32F4
- Priprava na povezovanje

- STM32 CubeIDE + Breadboard
 - LED, tipka, potenciometer, uporovna tipala
 - STM32H7
 - STM32F4

- DN2-VP3: Breadboard + STM32

Izhodišče : VIN LAB Breadboard STM32F4 IO Demo



Priključitev na STM32 : 1x analogni, 1x digitalni vhod, 1x digitalni izhod, 4x vgrajene LED diode

Testno vezje (primer) :

GPIO	Vrsta	Povezava
PA0	User tipka	
PA1	Analogni vhod	Rumena žička
PB4	Dig. Vhod	Zelena žička
PB5	Dig. Izhod - LED	Oranžna žička
PD12-PD15	Dig. Izhodi	vgr. LED diode

Breadboard vezava – STM32F4

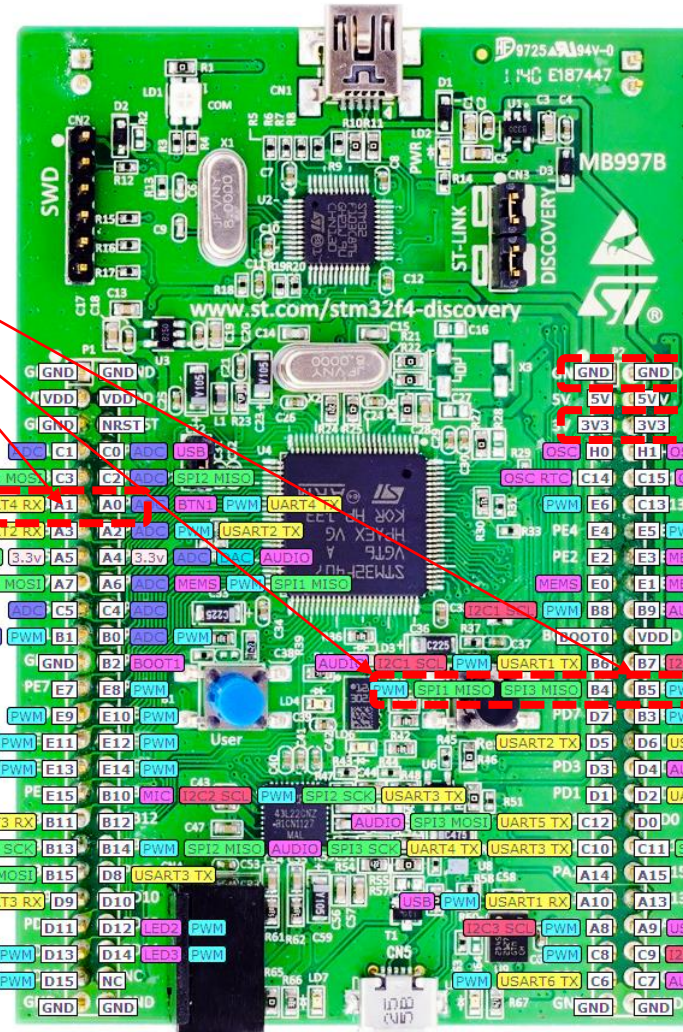
Priključitev na STM32 : 1x analogni, 1x digitalni vhod, 1x digitalni izhod, 4x vgrajene LED diode

Testno vezje (primer) :

GPIO	Vrsta	Povezava
PA0	User tipka	
PA1	Analogni vhod	Rumena žička
PB4	Dig. Vhod	Zelena žička
PB5	Dig. Izhod - LED	Oranžna žička
PD12-PD15	Dig. Izhodi	vgr. LED diode

P1

1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38
39	40
41	42
43	44
45	46
47	48
49	50



P2

1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38
39	40
41	42
43	44
45	46
47	48
49	50

Breadboard vezava – STM32F4

Priključitev na STM32 : 1x analogni, 1x digitalni vhod, 1x digitalni izhod, 4x vgrajene LED diode

Testno vezje (primer) :

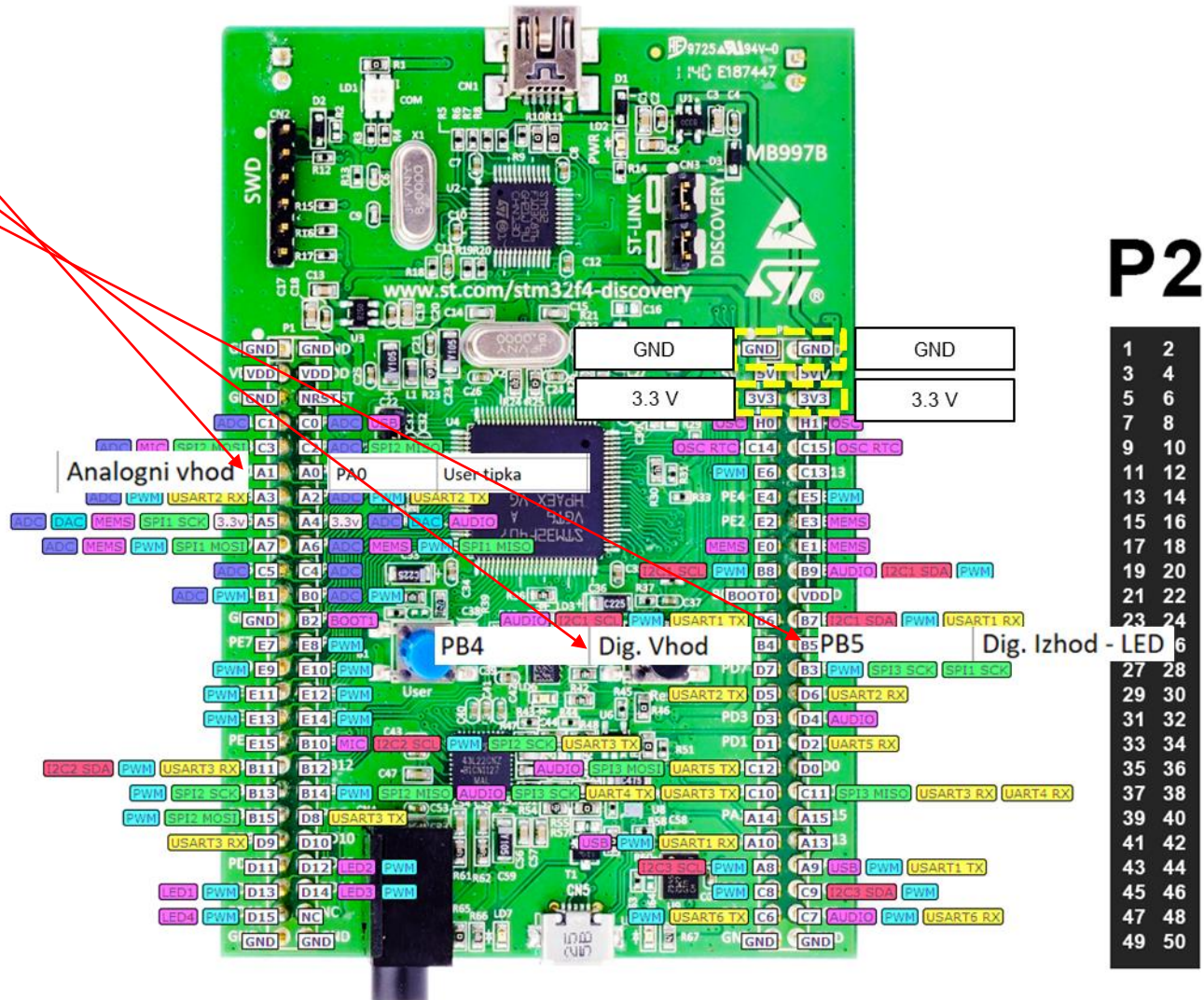
GPIO	Vrsta	Povezava
PA0	User tipka	
PA1	Analogni vhod	Rumena žička
PB4	Dig. Vhod	Zelena žička
PB5	Dig. Izhod - LED	Oranžna žička
PD12-PD15	Dig. Izhodi	vgr. LED diode

P1

1	2
3	4
5	6
7	8
9	10

PA1

13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38
39	40
41	42
43	44
45	46
47	48
49	50



P2

1	2
3	4
5	6
7	8
9	10

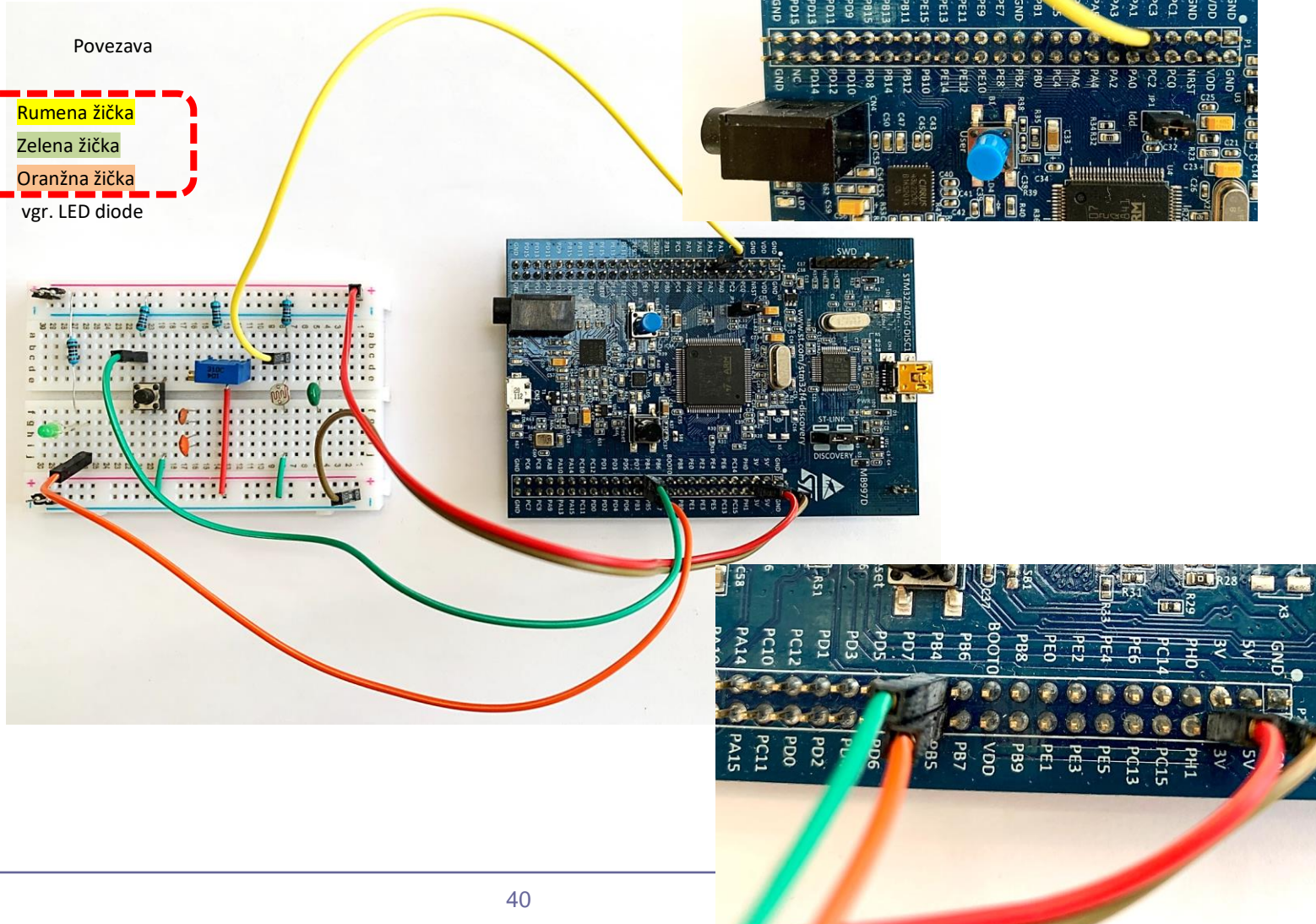
11	12
13	14
15	16
17	18
19	20
21	22
23	24
27	28
29	30
31	32
33	34
35	36
37	38
39	40
41	42
43	44
45	46
47	48
49	50

Breadboard vezava – STM32F4

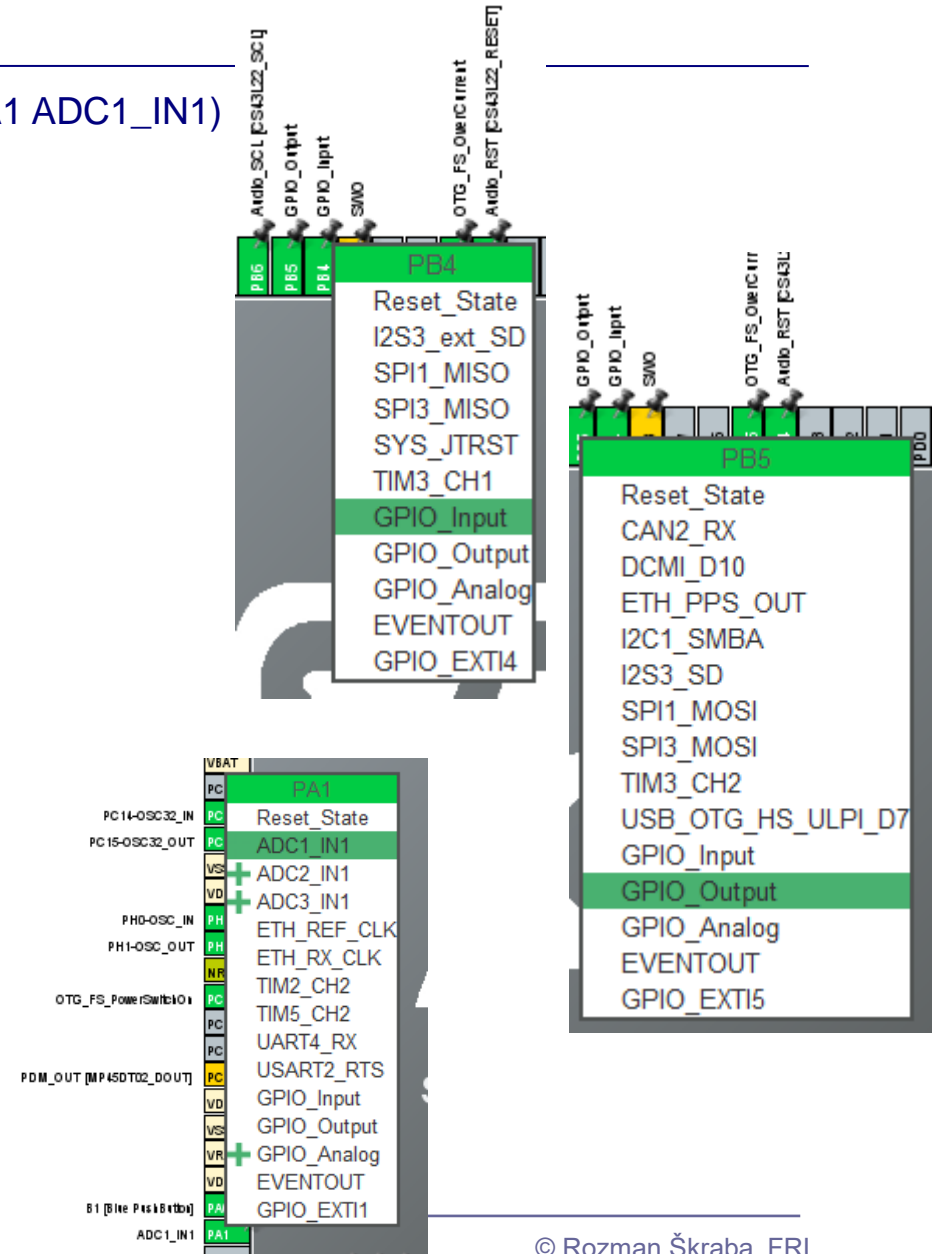
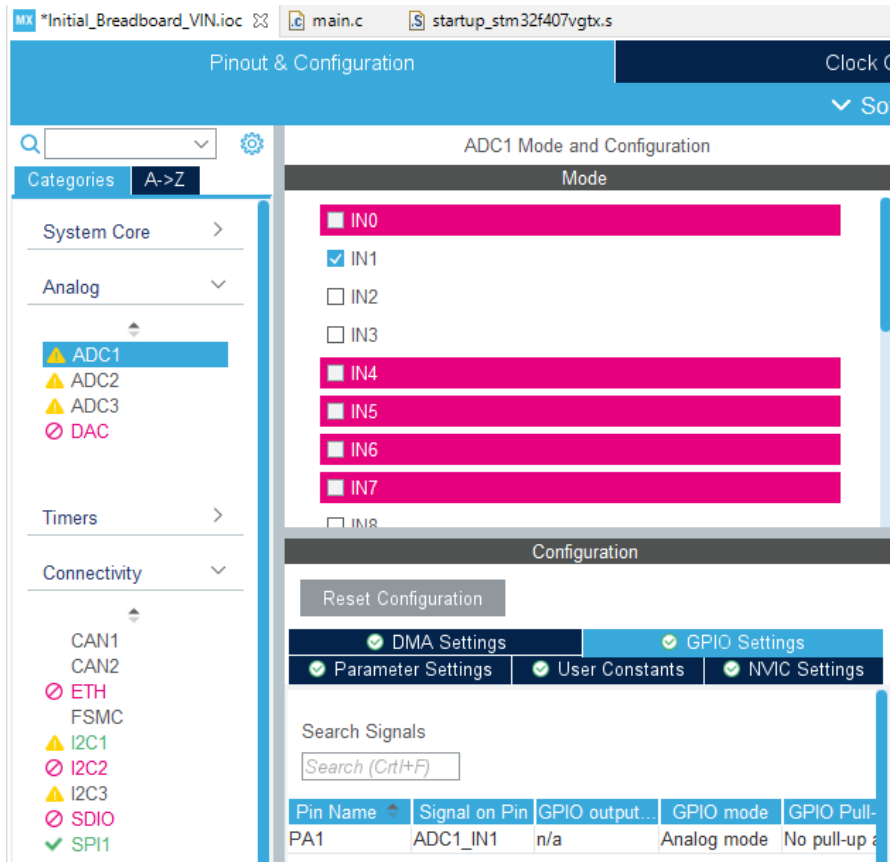
Priključitev na STM32 : 1x analogni, 1x digitalni vhod, 1x digitalni izhod, 4x vgrajene LED diode

Testno vezje (primer) :

GPIO	Vrsta	Povezava
PA0	User tipka	
PA1	Analogni vhod	Rumena žička
PB4	Dig. Vhod	Zelena žička
PB5	Dig. Izhod - LED	Oranžna žička
PD12-PD15	Dig. Izhodi	vgr. LED diode



Konfiguracija 2: (PB5 DIG_OUT, PB4 DIG_INP, PA1 ADC1_IN1)



VIN projekt - VP 5 STM32-CubeIDE projekt, breadboard vezave

Spremembe v projektu :



STM32F4

Pinout & Configuration

ADC1 Mode and Mode

A->Z

Categories

System... >

Analog

- ADC1
- ADC2
- ADC3
- DAC

<input type="checkbox"/>	IN0
<input checked="" type="checkbox"/>	IN1
<input type="checkbox"/>	IN2
<input type="checkbox"/>	IN3
<input type="checkbox"/>	IN4
<input type="checkbox"/>	IN5
<input type="checkbox"/>	IN6



The screenshot shows the STM32CubeIDE Pinout view for an STM32F407VGTx LQFP100. The PA1 pin is highlighted in a red dashed box and configured for 'Reset_State' and 'ADC1_IN1'. A list of available functions for this pin is shown in a separate window, also highlighted in a red dashed box, including:

- Reset_State
- CAN2_RX
- DCMI_D10
- ETH_PPS_OUT
- I2C1_SMBA
- I2S3_SD
- SPI1_MOSI
- SPI3_MOSI
- TIM3_CH2
- USB_OTG_HS_ULPI_D7
- GPIO_Input
- GPIO_Output
- GPIO_Analog
- EVENTOUT
- GPIO_EXTI5

Other pins shown in the configuration include:

- PC14-OSC32_IN
- PC15-OSC32_OUT
- PH0-OSC_IN
- PH1-OSC_OUT
- OTD_FS_PwrMgmtIO1
- FDM_OUT [MFA50T02_DOUT]
- OTD_FS_PwrMgmtIO1
- ADC1_IN1

VIN projekt - VP 5 STM32-CubeIDE projekt, breadboard vezave

Program : za branje tipal in pošiljanje po USB Virtual COM Port

```
/* Infinite loop */
/* USER CODE BEGIN WHILE */
while (1)
{
    HAL_ADC_Start(&hadc1);
    HAL_ADC_PollForConversion(&hadc1, HAL_MAX_DELAY);
    AnalogValue = HAL_ADC_GetValue(&hadc1);

    HAL_GPIO_TogglePin(GPIOD, GPIO_PIN_12); // On-board LED

    HAL_GPIO_TogglePin(GPIOB, GPIO_PIN_5); //External LED on PB5
    KeyState = HAL_GPIO_ReadPin(GPIOB, GPIO_PIN_4); //External Key on PB4

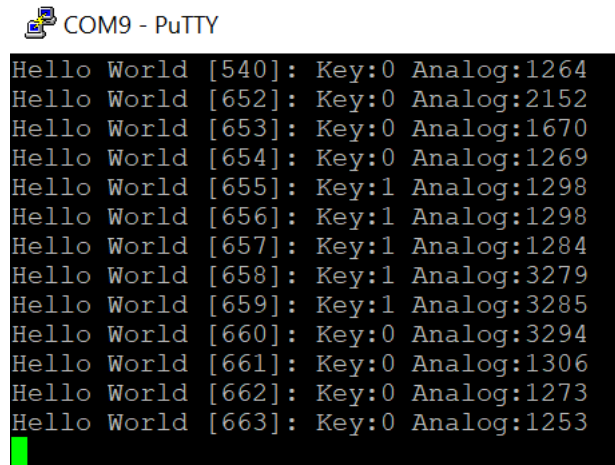
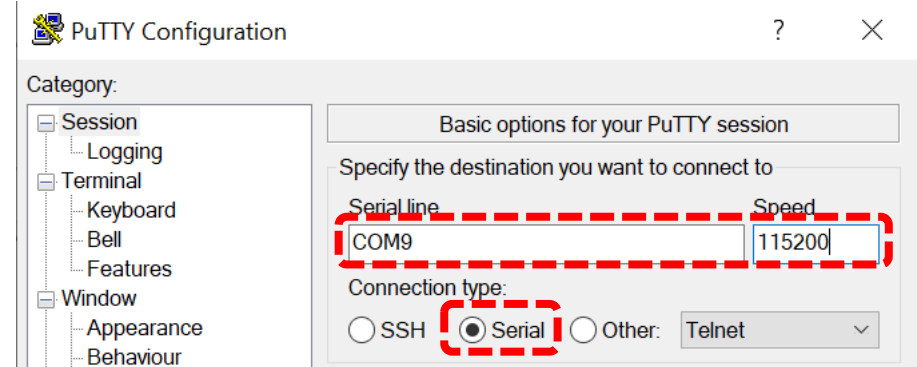
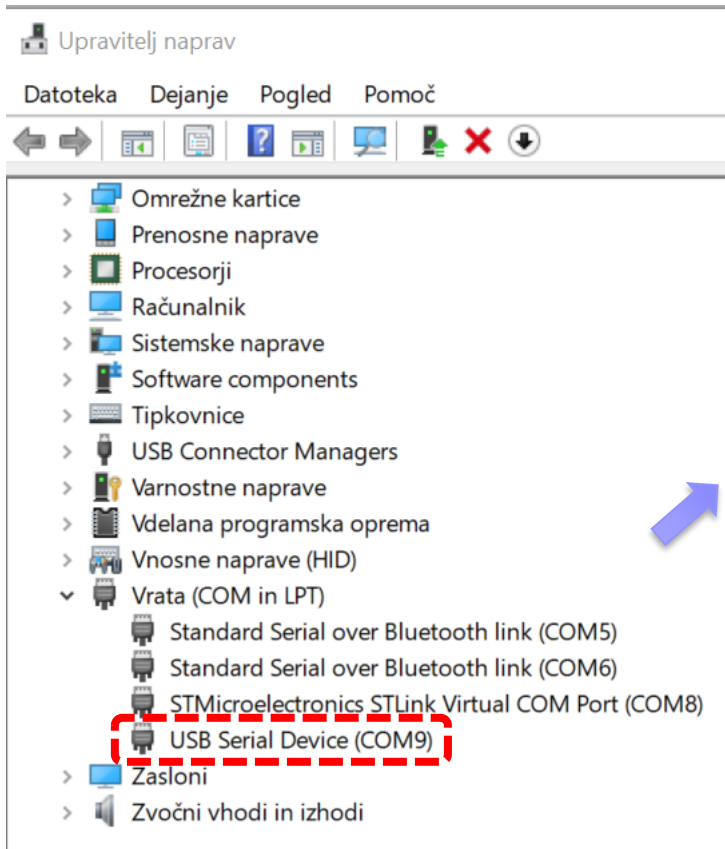
    snprintf (SendBuffer,BUFSIZE,"Hello [%d]: Key:%d Analog:%d\r\n",Counter++, 1-KeyState, AnalogValue);
    CDC_Transmit_FS(SendBuffer,strlen(SendBuffer));

    /* USER CODE END WHILE */

    /* USER CODE BEGIN 3 */
        HAL_Delay(1000);
    }
    /* USER CODE END 3 */
```

Osnovni projekt CubeIDE – USB Virtual COM Port

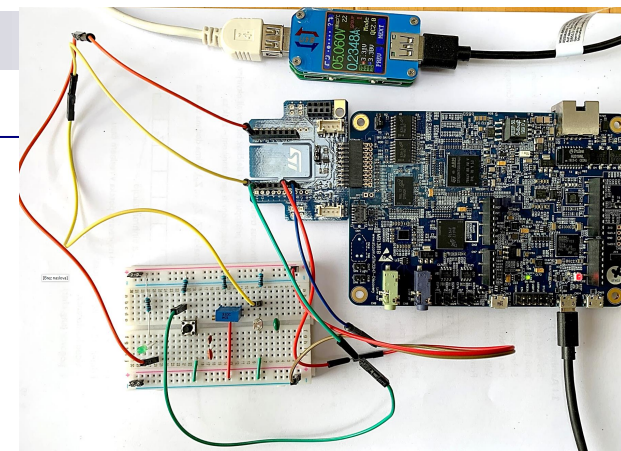
Program : sprejem na PC strani (povezava z dodatnim Micro-USB kablom)



VIN projekt - VP5: STM32-CubeIDE projekt, breadboard vezave

- Osvežitev: STM32 sistema
 - STM32H7
 - STM32F4
- Priprava na povezovanje
- STM32 CubeIDE + Breadboard
 - LED, tipka, potenciometer, uporovna tipala
 - STM32H7
 - STM32F4

- DN2-VP3: Breadboard + STM32



TinkerCad – DN2-VP3:

- Spada v sklop poročila z LAB vaj
- Naredite sebi zanimivo rešitev z ustrežno kodo
- Objavite v OneNote delovnem zvezku
- **_Prostor za sodelovanje, razdelek DN2-VP3 Breadboard**

