ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

Ipar 4.0 és IoT
MCU programozás

NTP-SZKOLL-23

ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

A szakkollégium 2023-24 évi működését támogatja a Nemzeti Tehetség Program és a Kulturális és Innovációs Minisztérium, az Emberi Erőforrás Támogatáskezelő által kiírt „Szakkollégiumok tehetséggondozó programjainak támogatása” című pályázata (NTP-SZKOLL-23-0056).

KULTURÁLIS ÉS INNOVÁCIÓS MINISZTÉRIUM

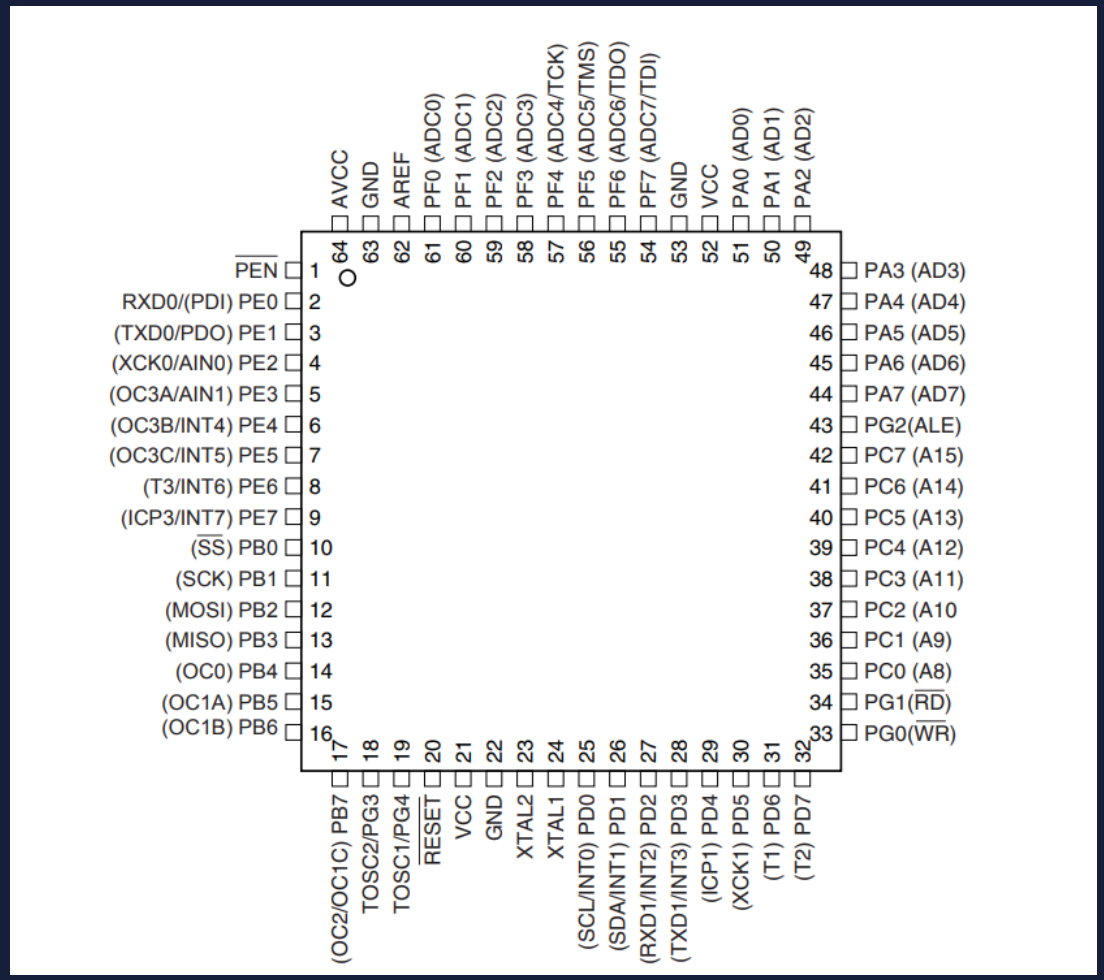
Nemzeti Tehetség Program

ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

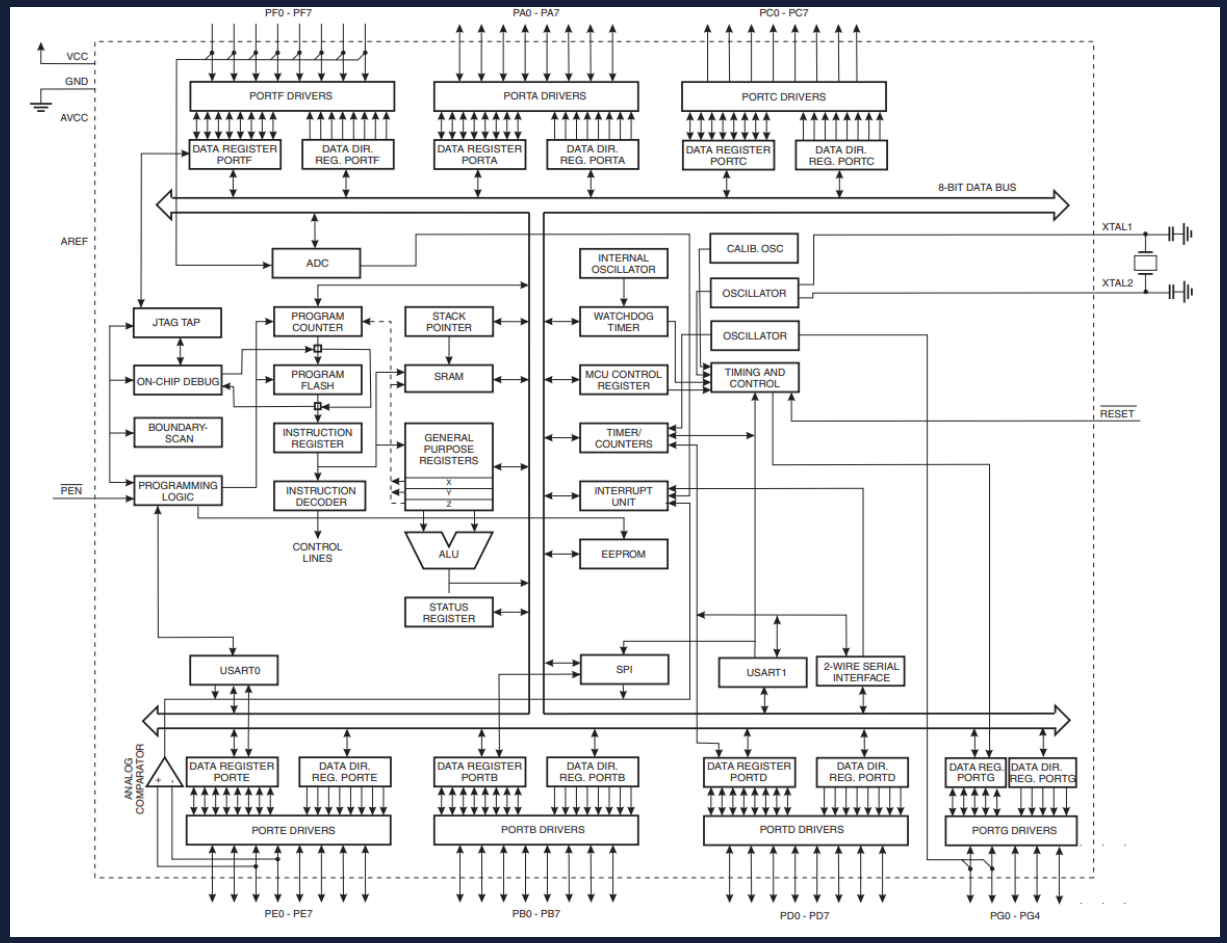
Features

- High-performance, Low-power Atmel AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - 130 Powerful Instructions – Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers + Peripheral Control Registers
  - Fully Static Operation
  - Up to 16 MIPS Throughput at 16 MHz
  - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory segments
  - 64 Kbytes of In-System Reprogrammable Flash program memory
  - 2 Kbytes EEPROM
  - 4 Kbytes 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
  - Up to 64 Kbytes Optional External Memory Space
  - Programming Lock for Software Security
  - SPI Interface for In-System Programming
- JTAG (IEEE std. 1149.1 Compliant) Interface
  - Boundary-scan Capabilities According to the JTAG Standard
  - Extensive On-chip Debug Support
  - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
  - Two Expanded 16-bit Timer/Counters with Separate Prescaler, Compare Mode, and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Two 8-bit PWM Channels
  - 6 PWM Channels with Programmable Resolution from 1 to 16 Bits
  - 8-channel, 10-bit ADC
    - 8 Single-ended Channels
    - 7 Differential Channels
    - 2 Differential Channels with Programmable Gain (1x, 10x, 200x)
  - Byte-oriented Two-wire Serial Interface
  - Dual Programmable Serial USARTs
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with On-chip Oscillator
  - On-chip Analog Comparator
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
  - Software Selectable Clock Frequency
  - ATmega103 Compatibility Mode Selected by a Fuse
  - Global Pull-up Disable
- I/O and Packages
  - 53 Programmable I/O Lines
  - 64-lead TQFP and 64-pad QFN/MLF
- Operating Voltages
  - 2.7V - 5.5V for Atmel ATmega64L
  - 4.5V - 5.5V for Atmel ATmega64
- Speed Grades
  - 0 - 8 MHz for ATmega64L
  - 0 - 16 MHz for ATmega64

ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

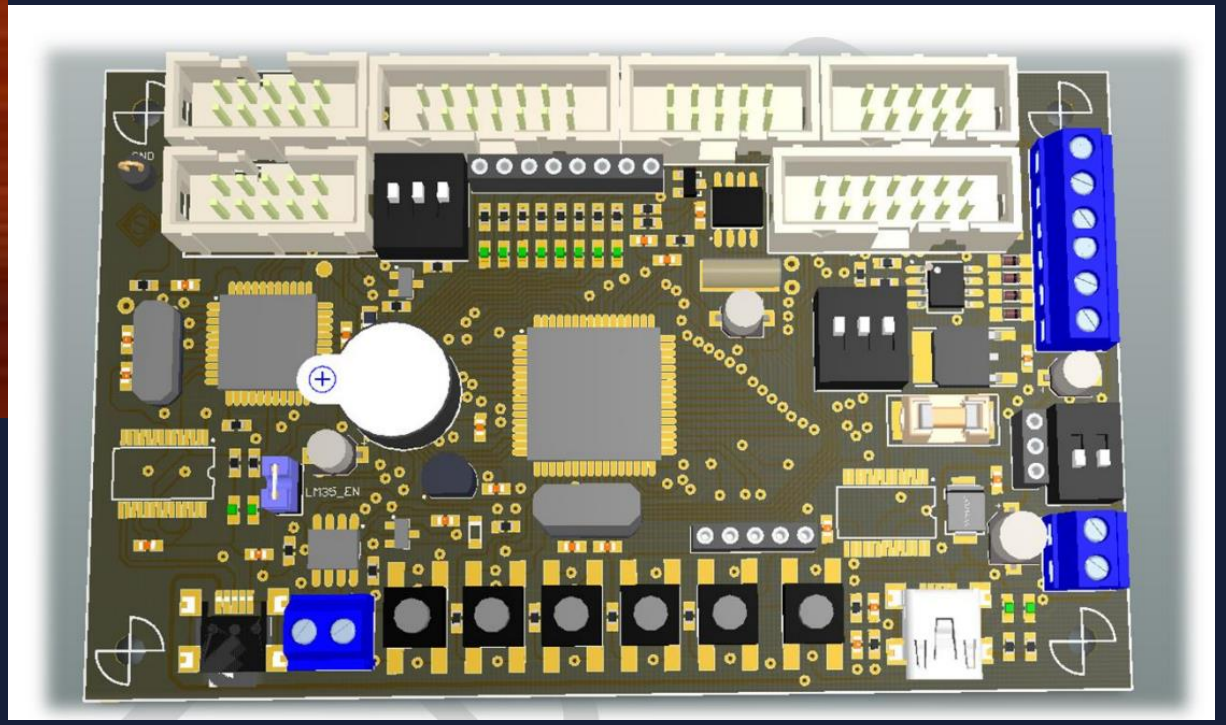


ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY



ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY



ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

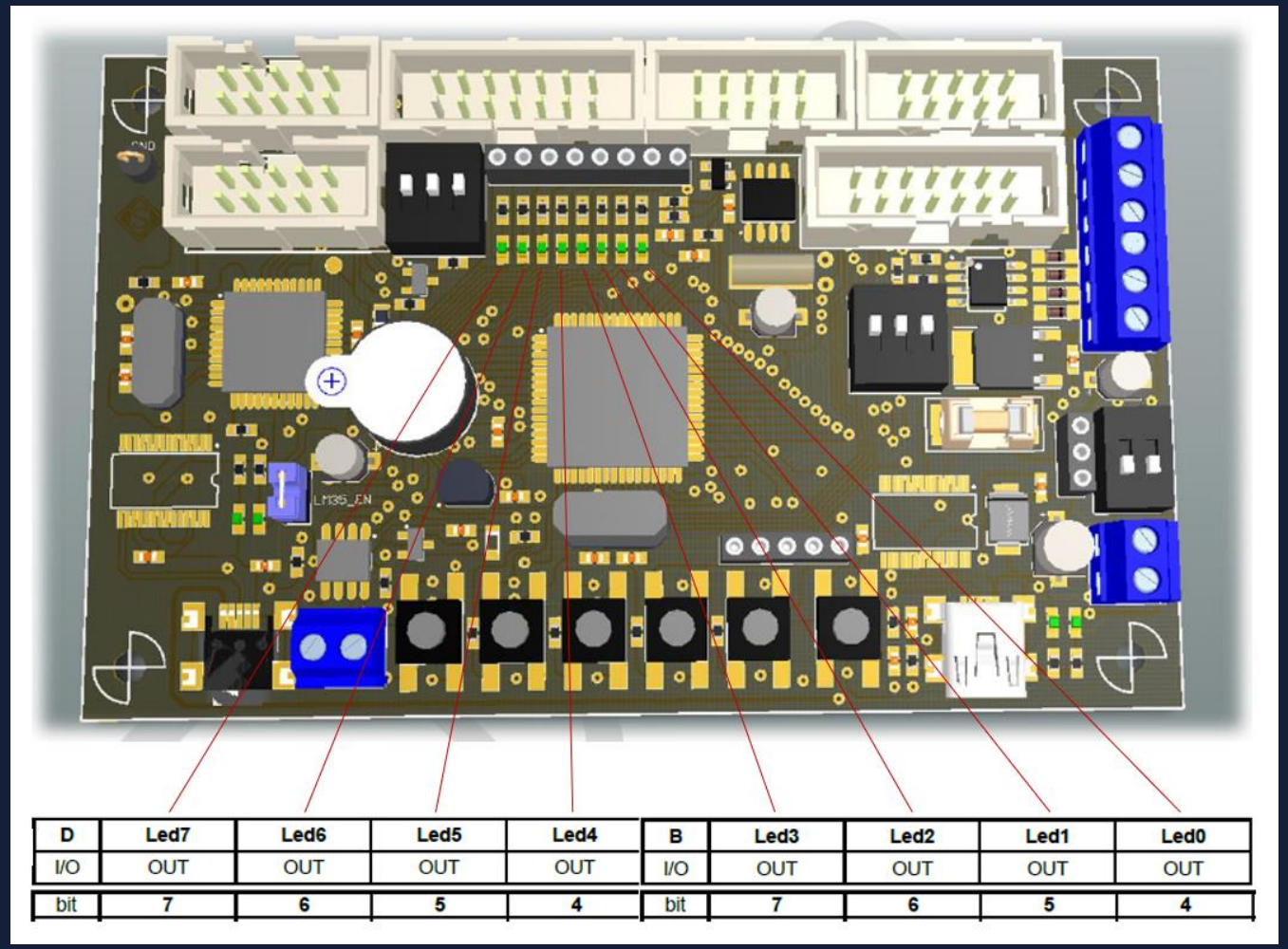
bit	7	6	5	4	3	2	1	0	
PORT									
A	**ENABLE**	**SEL2**	**SEL1**	**SEL0**	**DATA3**	**DATA2**	**DATA1**	**DATA0**	**7 SEGMENT DISPLAY**
I/O	OUT	OUT	OUT	OUT	OUT	OUT	OUT	OUT	
B	**Led3**	**Led2**	**Led1**	**Led0**					**LED/lo 4bit**
I/O	OUT	OUT	OUT	OUT					
C	**RED**	**KBD4row**	**KBD3row**	**KBD2row**	**KBD1row**	**KBD_right**	**KBD_centr**	**KBD_left**	**Keyboard**
I/O	OUT	OUT	OUT	OUT	OUT	IN	IN	IN	
D	**Led7**	**Led6**	**Led5**	**Led4**					**LED/hi 4bit**
I/O	OUT	OUT	OUT	OUT					
E	**LCD_DATA7**	**LCD_DATA6**	**LCD_DATA5**	**LCD_DATA4**	**GREEN**	**BLUE**			**LCD data**
I/O	OUT	OUT	OUT	OUT	OUT	OUT			
F					**LCD_E**	**LCD_R/W**	**LCD_RS**	**LM35**	**LCD Control**
I/O					OUT	OUT	OUT	IN	**Analog**
G	NC	NC	NC	**K4**	**K3**	**K2**	**K1**	**K0**	**Pushbutton**
I/O	X	X	X	IN	IN	IN	IN	IN	
bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	

7 Segment display: E 1:Enable, 0: Disable; SEL 2-1-0: 000:10exp0, 001: 10exp1, 010:10exp2, 011:10exp3, 100:Double Leds

Led0…7: 0: Disable, 1:Enable; RED,GREEN,BLUE: 0 Disable, 1: Enable; KBDrow: 1: Select; Column: 0: Pressed

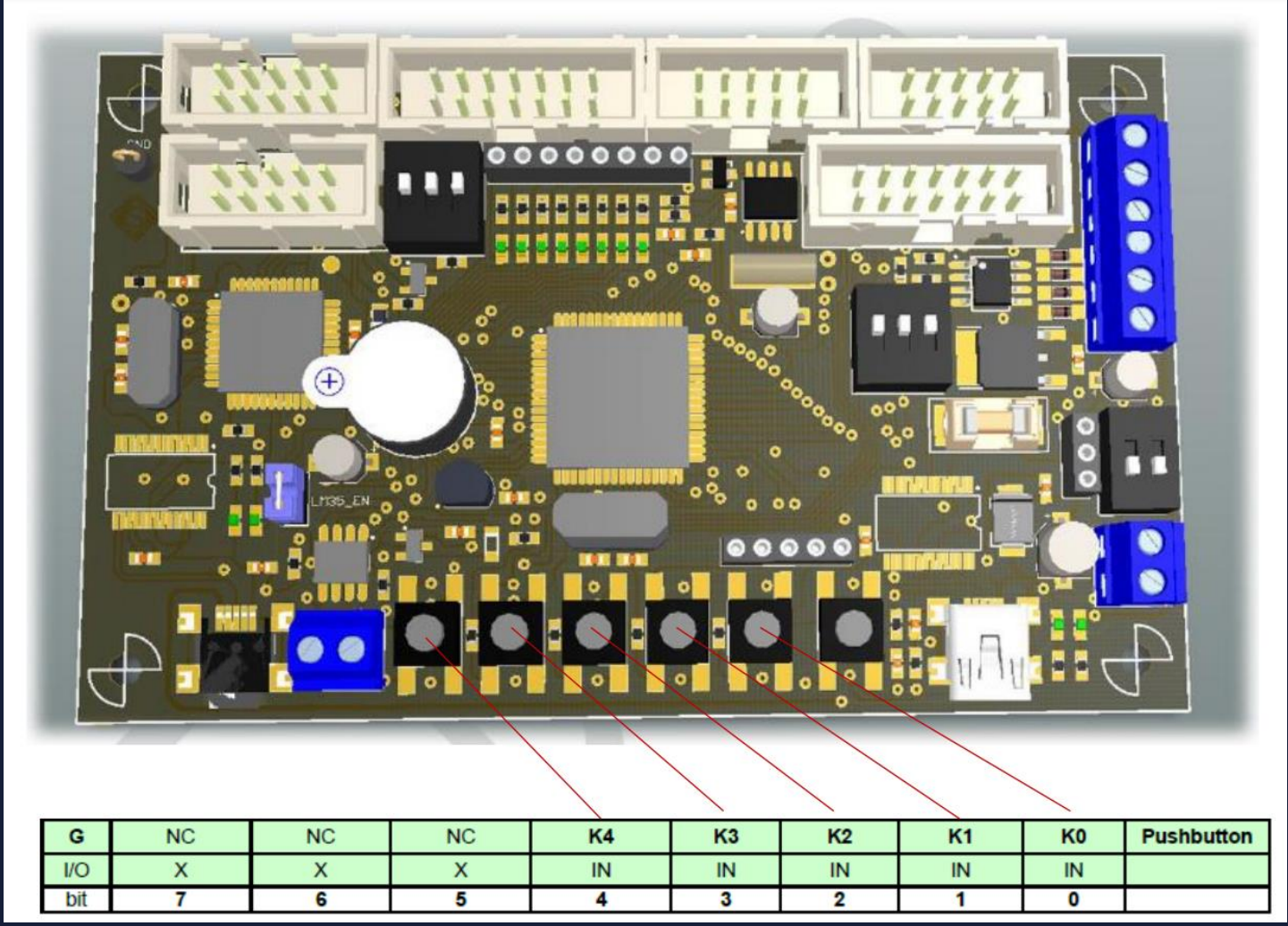
LCD_E: 0 Select, LCD_R/W: 1:Read, 0: Write; LCD_RS: 1: Data, 0: Control

ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY



D	Led7	Led6	Led5	Led4	B	Led3	Led2	Led1	Led0
I/O	OUT	OUT	OUT	OUT	I/O	OUT	OUT	OUT	OUT
bit	7	6	5	4	bit	7	6	5	4

ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY



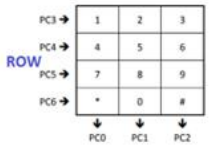
G	NC	NC	NC	K4	K3	K2	K1	K0	Pushbutton
I/O	X	X	X	IN	IN	IN	IN	IN	
bit	7	6	5	4	3	2	1	0	

DIGIT3	DIGIT2	:	DIGIT1	DIGIT0

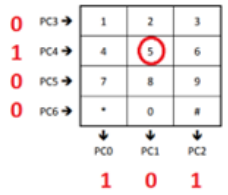
bit	7	6	5	4	3	2	1	0	
PORT									
A	ENABLE	SEL2	SEL1	SEL0	DATA3	DATA2	DATA1	DATA0	7 SEGMENT DISPLAY
I/O	OUT	OUT	OUT	OUT	OUT	OUT	OUT	OUT	

ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

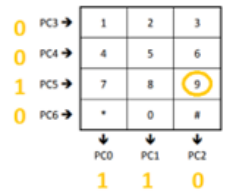
Key	Address				Read							
	PC3	PC4	PC5	PC6	PC6	PC5	PC4	PC3	PC2	PC1	PC0	
1									1	1	0	14
2	1	0	0	0	0	0	0	1	1	0	1	13
3									0	1	1	11
4									1	1	0	22
5	0	1	0	0	0	0	1	0	1	0	1	21
6									0	1	1	19
7									1	1	0	38
8	0	0	1	0	0	1	0	0	1	0	1	37
9									0	1	1	35
*									1	1	0	70
0	0	0	0	1	1	0	0	0	1	0	1	69
#									0	1	1	67

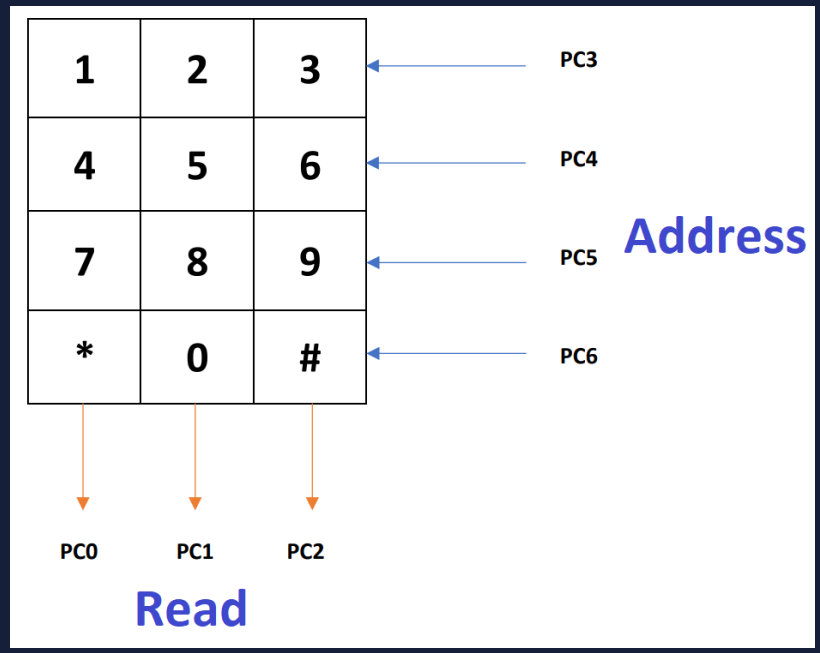


Key	Address				Read							
	PC3	PC4	PC5	PC6	PC6	PC5	PC4	PC3	PC2	PC1	PC0	
1									1	1	0	14
2	1	0	0	0	0	0	0	1	1	0	1	13
3									0	1	1	11
4									1	1	0	22
5	0	1	0	0	0	0	1	0	1	0	1	21
6									0	1	1	19
7									1	1	0	38
8	0	0	1	0	0	1	0	0	1	0	1	37
9									0	1	1	35
*									1	1	0	70
0	0	0	0	1	1	0	0	0	1	0	1	69
#									0	1	1	67



Key	Address				Read							
	PC3	PC4	PC5	PC6	PC6	PC5	PC4	PC3	PC2	PC1	PC0	
1									1	1	0	14
2	1	0	0	0	0	0	0	1	1	0	1	13
3									0	1	1	11
4									1	1	0	22
5	0	1	0	0	0	0	1	0	1	0	1	21
6									0	1	1	19
7									1	1	0	38
8	0	0	1	0	0	1	0	0	1	0	1	37
9									0	1	1	35
*									1	1	0	70
0	0	0	0	1	1	0	0	0	1	0	1	69
#									0	1	1	67





C	RED	KBD4row	KBD3row	KBD2row	KBD1row	KBD_right	KBD_centr	KBD_left	Keyboard
I/O	OUT	OUT	OUT	OUT	OUT	IN	IN	IN	

RGB RED

KBDrow: 1: Select; Column: 0: Pressed

ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

HONLAP ÉS FACEBOOK

ÓBUDAI EGYETEM
ÓBUDA UNIVERSITY

Köszönettel!

Kandó Kálmán Villamosmérnöki Szakkollégium