

SEL0337

Aplicação de Microprocessadores II

Prática 1 – Temporização e Interrupção

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Prática Preliminar

- Objetivo:
 - Aprendizado do microcontrolador PIC18F4550
 - Uso das portas de I/O, temporizadores e interrupção
 - Uso da Linguagem C para microprocessadores
 - Uso do Compilador - Mikro C Pro for PIC
 - Uso do Simulador de Circuito - SimulIDE
- Prática:
 - Fazer um Display de 7 segmentos contar (mostrar os números na sequência) quando um botão é pressionado.

Prática Preliminar

- Quando um botão na porta RB0 for pressionado, um display de 7 segmentos ligado na Porta D deve contar (de 0 a 9 em *loop*) com período de 1s.
- Quando um botão na porta RB1 for pressionado, o mesmo display de 7 segmentos deve contar com período de 0,25s.
- Utilizar o temporizador TMR0 com Interrupção para gerar as bases de tempo do contador.
- A frequência do clock do PIC deve ser de 8 MHz.

Obs. Se for usar o Kit EasyPIC, a escolha do display (multiplexação) é realizada utilizando a Porta A do PIC (ver manual do Kit).

Input/Output Group

One of the most distinctive features of EasyPIC™ v7 are its Input/Output PORT groups. They add so much to the connectivity potential of the board.

Everything is grouped together

PORT **headers**, PORT **buttons** and PORT **LEDs** are next to each other, and grouped together. It makes development easier, and the entire EasyPIC™ v7 cleaner and well organized. We have also provided an **additional PORT headers** on the left side of the board, so you can access any pin you want from both sides of the board. Some PORT pins are directly connected to the microcontroller, and some that are connected to other on-board modules are enabled via jumpers (for example USB jumpers, **J12** and **J18**).

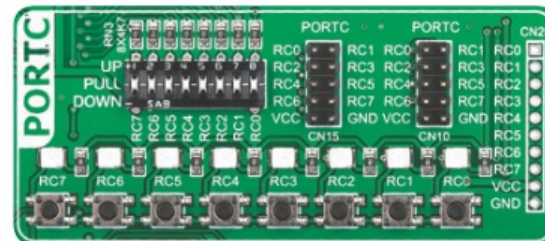


Figure 10-1: I/O group contains PORT headers, tri-state pull up/down DIP switch, buttons and LEDs all in one place

Tri-state pull-up/down DIP switches

Tri-state DIP switches, like **SW7** on **Figure 10-2**, are used to enable 4K7 pull-up or pull-down resistor on any desired port pin. Each of these switches has three states:

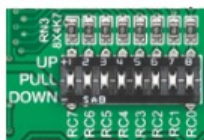


Figure 10-2: Tri-state DIP switch on PORTC

1. **middle position** disables both pull-up and pull-down feature from the PORT pin
2. **up position** connects the resistor in pull-up state to the selected pin
3. **down position** connects the resistor in pull-down state to the selected PORT pin.

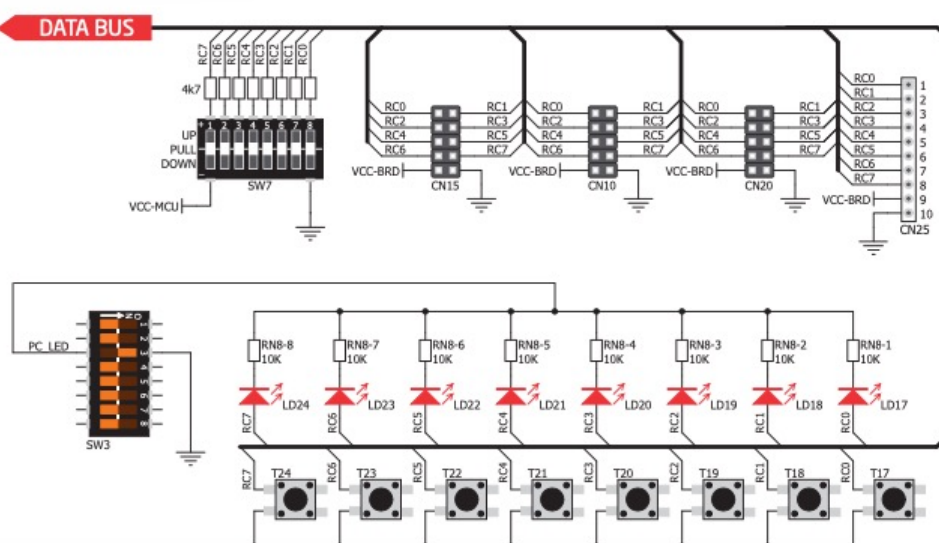
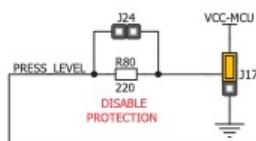
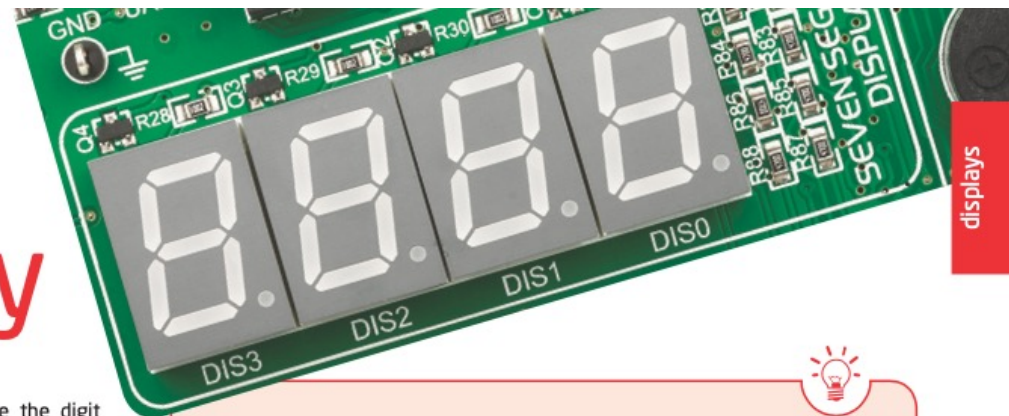


Figure 10-3: Schematic of the single I/O group connected to microcontroller PORTC

4 digit 7-seg display

One seven segment digit consist of 7+1 LEDs which are arranged in a specific formation which can be used to represent digits from 0 to 9 and even some letters. One additional LED is used for marking the decimal dot, in case you want to write a decimal point in the desired segment. EasyPIC™ v7 contains four of these digits put together to form 4-digit 7-segment display. Driving such a display is done using **multiplexing techniques**. Data lines are shared between segments, and therefore the same segment LEDs in each digit are connected in parallel. Each digit has its **unique digit select line**,

which is used to enable the digit to which the data is currently being sent. By multiplexing data through all four segments fast enough, you create an illusion that all four segments are in operation simultaneously. This is possible because human eye has a slower reaction time than the mention changes. This way you can represent numbers in decimal or hexadecimal form. Eight data lines that are common for all the digits are connected to PORTD, and digit select lines are connected to RA0-RA3 lines on the microcontroller sockets.



Enabling the display

To enable digit select lines for the 4-digit 7-segment display you have to turn on **SW4.1, SW4.2, SW4.3** and **SW4.4** switches. Digit select lines are connected to **RA0 - RA3** pins on the microcontroller sockets, while data lines are connected to **RD0 - RD7** pins. Make sure to disconnect other peripherals from the interface lines in order not to interfere with signal/data integrity.

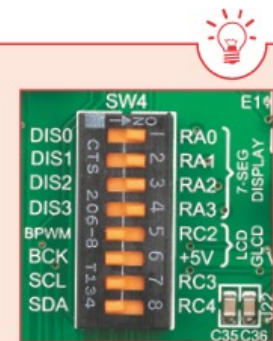


Figure 14-1: Turn on switches 1 through 4 on SW4 to enable 4-digit 7-seg display

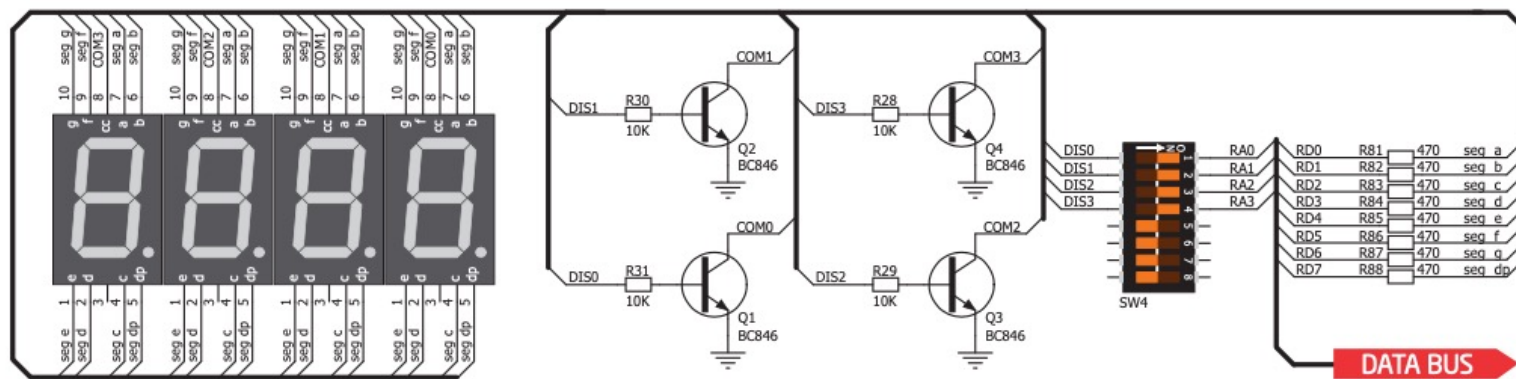


Figure 14-2: 4-digit 7-segment display schematic

Prática Preliminar

- A prática deve ser feita no Micro C Pro for PIC
 - Programa em C
 - Compilar e Simular (debugger)
- Montar o circuito no SimulIDE
 - Circuito digital (PIC, Display, Botões)
 - Carregar o programa no PIC
 - Simular: fazer os displays contarem de acordo com o botão apertado
 - Validar a prática: Usar um frequencímetro ou osciloscópio para mostrar a frequência da onda gerada do display

Relatório Prática 1

- Colocar introdução, objetivos, resultados, conclusões, etc.
– *consultar as normas para confecção de relatórios no site da disciplina.*
- Colocar trechos do programa desenvolvido (comentado).
- Enviar também os arquivos do projeto gerados pelo compilador (código em C) e pelo SimulIDE;
- Pode gravar pelo celular o circuito funcionando e enviar o vídeo se quiser;
- Enviar os arquivos pelo site do e-disciplinas até a data definida pelo professor (**24/10/2021 – 23:59h**).