EduKit84

Educational Kit with PIC16F84A and on-board programming for MU Alpha / MU Beta Emulators

User's manual



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1. Introduction

EduKit84 is a PIC16F84A[®] based educational board designed as an add-on to MU Alpha and MU Beta emulators by ASIX s.r.o. It allows for debugging of both the simple and complex applications with the PIC16F84A microcontroller.

The combination of EduKit84 board with MU Alpha emulator is especially suitable for the beginners who want to learn microcontroller programming. They obtain a combination of emulator, programmer and development board with MCU for an affordable price. CD-ROM ASIX compact disc contains brief commented program examples.

PIC programming using EduKit84 and the emulator is efficient, apparent and professional; the user debugs the application software using emulator, then - without need of additional hardware - programs the PIC MCU Flash memory directly in EduKit84 and finally verifies if the software works with the real device, too.

2. The Equipment Description

EduKit84 is primarily intended as an add-on option to MU Alpha and MU Beta emulators by ASIX s.r.o. It is possible to use it also separately, but the user must use an external programmer in that case.

The board integrates following peripherals:

- LED diode
- 4-digit 7-segment LED display
- 8 pushbuttons
- Crystal oscillator
- Reset button

The board further contains power supply circuits, mode switch and connector to the emulator.

3. Operation Modes

EduKit84 has two operating modes selectable by the mode switch. If the switch resides in the 'PIC16F84' position, the emulator is inactive and the peripherals are controlled by the on-board MCU. If the switch is in the 'MU ALPHA' position, the peripherals are under control of the emulator and the on-board PIC16F84A MCU is being held in the reset state. This mode also allows for the on-board device programming.

4. PIC16F84A Microcontroller

PIC16F84 is clocked by an oscillator with an external crystal with frequency of 3.2768 MHz.

The -MCLR pin is connected to +5V via pull-up resistor, thus, if the emulator is disconnected, the microcontroller with the program loaded in it starts running just after the power is applied. Reset can be invoked using the BT8 pushbutton.

Port A bits 0..3 are used to control transistors Q0 to Q3 connected to anodes of 7-segment displays. Bit 4 of the port A is connected through cca 1 kOhm resistor to a single LED.

Port B connects through 220 Ohm resistors to cathodes of the display segments. Furthermore, the pushbuttons BT0 to BT7 are connected via resistors of 4.7 kOhm to the ground. In addition, there are 47 kOhm pull-up resistors connected to this port.

5. PIC16F84A Ports Connections

5.1. Port A

bit 0	Output, log. 0 activates 1st (lower) display digit
bit 1	Output, log. 0 activates 2nd display digit
bit 2	Output, log. 0 activates 3rd display digit
bit 3	Output, log. 0 activates 4th (upper) display digit
bit 4	Output, log. 0 sets single red LED on

5.2. Port B

bit 0	Output:	Log. 0 lights on segment A of the activated digit of the display
	Input:	Pushbutton state – log. 0 means that button BTO is pressed
bit 1	Output:	Log. 0 lights on segment B of activated digit of the display
	Input:	Pushbutton state – log. 0 means that button BT1 is pressed
bit 2	Output:	Log. 0 lights on segment C of activated digit of the display
	Input:	Pushbutton state – log. 0 means that button BT2 is pressed
bit 3	Output:	Log. 0 lights on segment D of activated digit of the display
	Input:	Pushbutton state – log. 0 means that button BT3 is pressed
bit 4	Output:	Log. 0 lights on segment E of activated digit of the display
	Input:	Pushbutton state – log. 0 means that button BT4 is pressed
bit 5	Output:	Log. 0 lights on segment F of activated digit of the display
	Input:	Pushbutton state – log. 0 means that button BT5 is pressed
bit 6	Output:	Log. 0 lights on segment G of activated digit of the display
	Input:	Pushbutton state – log. 0 means that button BT6 is pressed
bit 7	Output:	Log. 0 lights on decimal point of activated digit of the display
	Input:	Pushbutton state – log. 0 means that button BT7 is pressed

6. On-board Peripheals

6.1. Single LED

The LED is on if the bit 4 of the port A is configured as an output and log. 0 is written into it. To turn the LED off, set the pin to log. 1.

6.2. Display

7-segment LED display devices are used. The display is designated to be used in multiplexed mode. The segment is on if there is log. 0 on the appropriate bit of the port B (which selects a segment) and at the same time log. 0 is on the appropriate pin of the port A (which selects

a 7-segment device). If the switching is fast enough (>25 Hz), display shows characters without visible flashing of the segments.

6.3. Pushbuttons

Reading data from port B defined as input allows to detect the state of the pushbuttons. Log. 0 on the appropriate pin indicates that the button is pressed. Since the buttons are serially connected with resistors, no short connections appear when button is pressed, which ensures that the display can be controlled concurrently while reading the buttons in meantime.

7. Power

A power supply with following parameters can be used:

8 to 15 V DC, at least 100 mA, connector 2,1 mm. Recommended: 9 V, 300 mA. If the voltage is lower, correct function cannot be guaranteed. Power is indicated by a green LED. The voltage may not exceed 20V in any case, including peaks.

8. Programming

Circuitry is designed according Microchip programming specifications. Programming is controlled by the emulator (MU Alpha, MU Beta, ..). Switching the processor to programming mode is indicated by yellow LED. Peripherals are inactive in this mode (APP LED and display are off).

9. EduKit84 Schematics







10. EduKit84 board layout

11. Further information

[1] http://www.pic-tools.com[2] http://www.microchip.com

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