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BIG8051™

All MikroElektronika´s development systems represent irreplaceable tools for programming and developing microcontroller-based devices. Carefully chosen components and the use of machines of the last generation for mounting and testing thereof are the best guarantee of high reliability of our devices. Due to simple design, a large number of add-on modules and ready to use examples, all our users, regardless of their experience, have the possibility to develop their project in a fast and efficient way.

Development system

ⓘⒺ MikroElektronika
SOFTWARE AND HARDWARE SOLUTIONS FOR EMBEDDED WORLD . . . making it simple

TO OUR VALUED CUSTOMERS

I want to express my thanks to you for being interested in our products and for having confidence in Mikroelektronika.
The primary aim of our company is to design and produce high quality electronic products and to constantly improve the performance thereof in order to better suit your needs.

Nebojsa Matic
General Manager

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General information

The *BIG8051* development system provides a development environment for programming and experimenting with 8051 microcontrollers from Sillicon Labaratories®. Numerous modules, such as 128x64 graphic LCD display, 2x16 alphanumeric LCD display, piezo buzzer, CAN, ZigBee, etc, are provided on the board and allow you to easily simulate the operation of your target device.

Full-featured development system for 8051 microcontroller based devices

Analog to digital conversion of voltage signal

CAN communication module

Access to LAN network

Graphic LCD display with backlight

Package contains:

Development system:	BIG8051
CD:	product CD with relevant software
Cables:	USB cable
Documentation:	Manual for BIG8051 and electrical schematic of the development system

System specification:

Power supply:	over AC/DC connector (7-23V AC or 9-32V DC) or a USB cable (5V DC)
Power consumption:	50mA when all on-board modules are off
Dimensions:	26,5 x 22cm (10,4 x 8,6inch)
Weight:	~420g (0.92lbs)
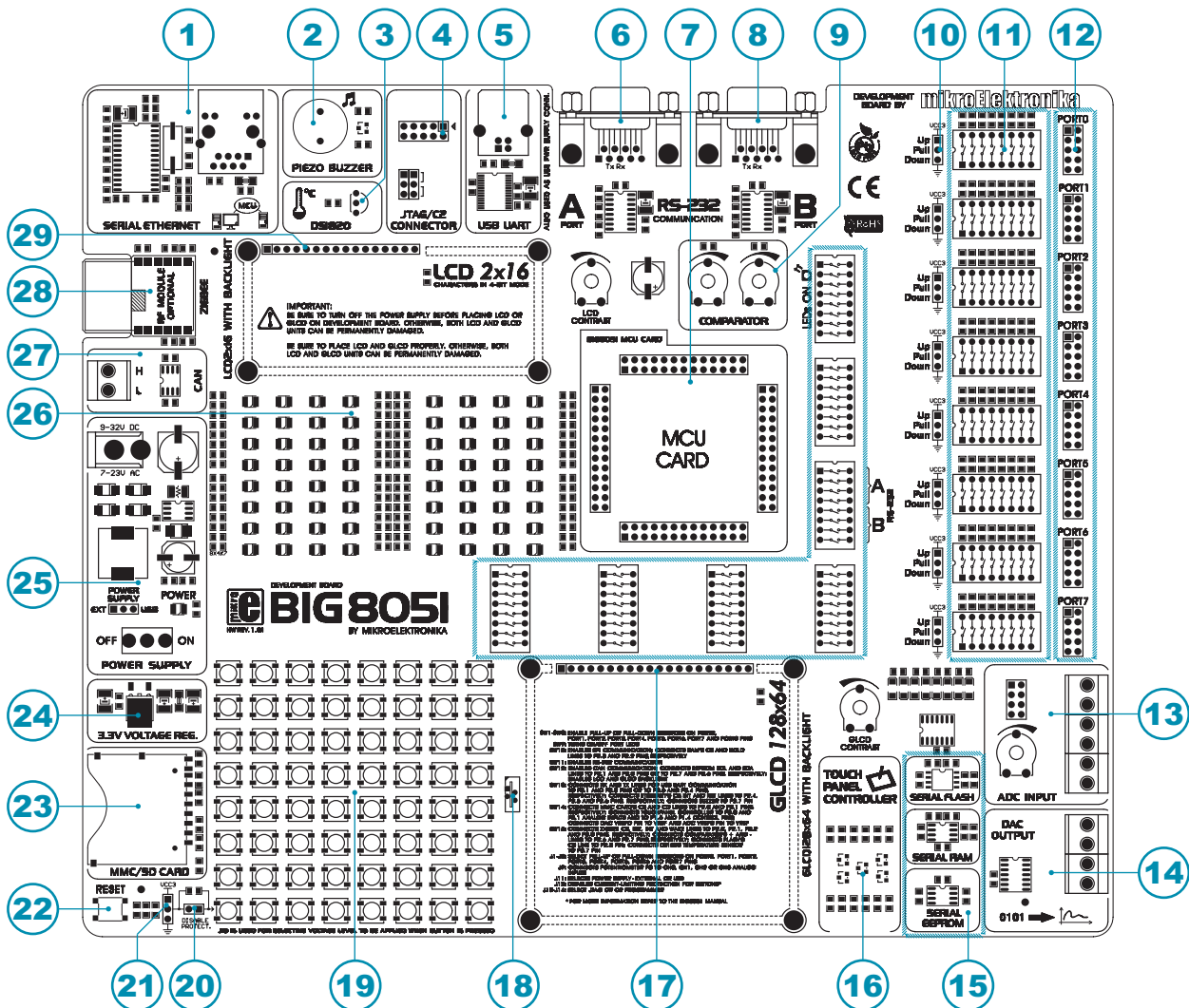
Key features

1. Ethernet module
2. Piezo buzzer
3. Connector for temperature sensor
4. Connector for programmer
5. USB UART module also used as a USB power supply connector
6. RS-232A module
7. Connector for MCU card
8. RS-232B module
9. Comparator
10. Jumpers used to select pull-up/pull-down resistors
11. DIP switches used to turn on pull-up/pull-down resistors
12. I/O ports
13. A/D converter inputs
14. D/A converter outputs
15. Memory modules
16. Touch panel controller
17. Connector for GLCD display
18. Connector for touch panel
19. Push buttons
20. Jumper used to shorten protective resistor
21. Jumper used to select push buttons' logic state
22. Reset button
23. Connector for MMC/SD cards
24. 3.3V voltage regulator
25. Power supply module
26. LEDs
27. CAN module
28. ZigBee module
29. Connector for LCD display

1.0. Connecting the development system to a power supply

In order to enable the development system to be turned on, it is necessary to provide the power supply voltage over an AC/DC connector CN19, Figure 1-1.
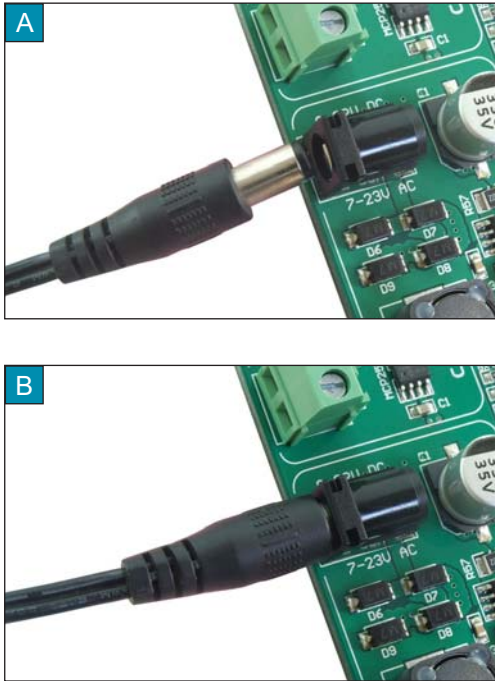
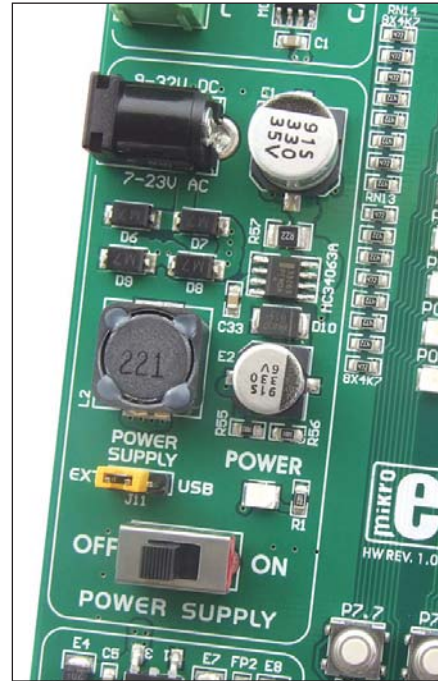**Figure 1-1:** Providing power supply voltage

Figure 1-2: Power supply module

The power supply voltage provided via the CN19 AC/DC connector may be in a range between 9 and 32V DC or 7 and 23V AC. Before you turn the development system on, it is necessary to place jumper J11 in the EXT position.

When the development system is powered, it is necessary to set switch marked POWER SUPPLY to the ON position. As soon as the development system is turned on, a green LED marked POWER will automatically illuminate.
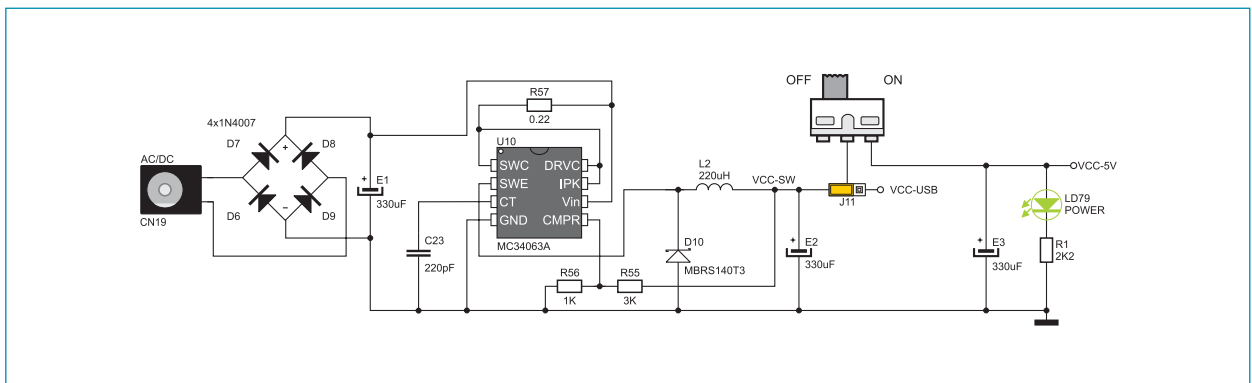
Figure 1-3: Power supply module connection schematic

2.0. C8051F040 microcontroller

The *BIG8051* development system comes with a 100-pin microcontroller C8051F040 in TQFP package. The microcontroller is soldered on the MCU card. It's key features are as follows:

- Pipelined instruction architecture executes 70% of instruction set in 1 or 2 system clocks;
- Up to 25 MIPS throughput with 25 MHz clock;
- 4352 bytes internal data RAM (4 k + 256);
- 64 kB Flash; in-system programmable in 512-byte sectors;
- Bosch Controller Area Network (CAN 2.0B), hardware SMBus™ (I2C™ Compatible), SPI™, and two UART serial ports available concurrently;
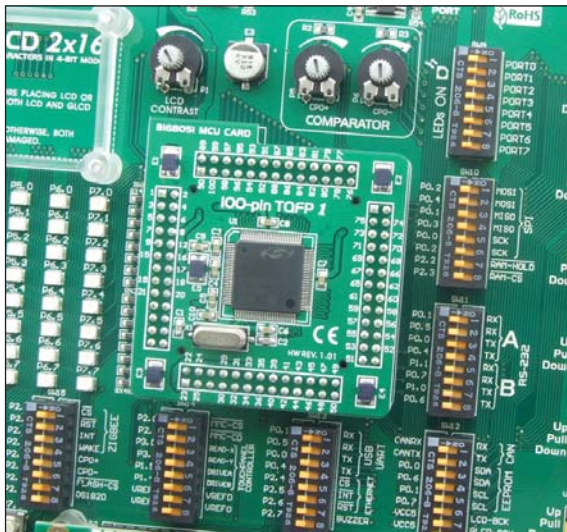- Internal calibrated programmable oscillator: 3 to 24.5 MHz; etc.

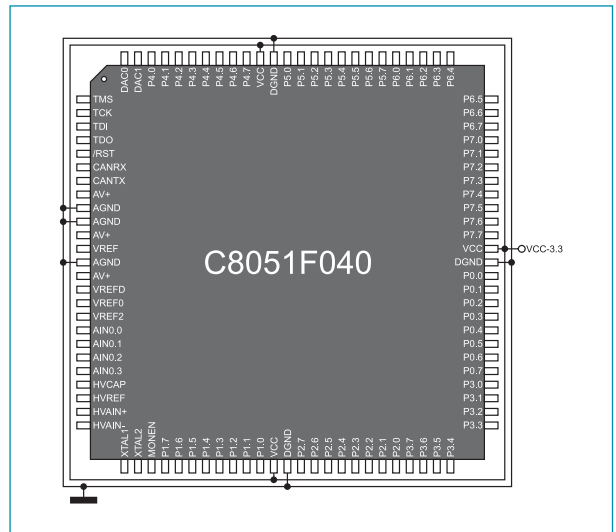**Figure 2-1:** Microcontroller C8051F040

Figure 2-2: Microcontroller's pinout

The microcontroller provided on the development system can be easily replaced with another one. When choosing another microcontroller, it is very important to compare its and C8051F040's pinouts to make sure that they are compatible. If you use a microcontroller with different pinout, some on-board modules will probably not work. Anyway, if you decide to use another microcontroller, it is also necessary to provide an MCU card to solder the new microcontroller on.

3.0. Programming microcontroller

The C8051F040 microcontroller provided on the development system is programmed with a USB DEBUG ADAPTER that comes with the development system, Figure 3-1.

Before you start programming, it is necessary to turn the development system on. The external programmer is connected to the development system via a 2x5 connector CN23, Figure 3-4. In order to enable the JTAG programmer, jumpers J13 and J14 should be placed in the JTAG position, Figure 3-2A. In case the C2 programmer is used, jumpers 13 and J14 should be placed in the C2 position, Figure 3-2B.
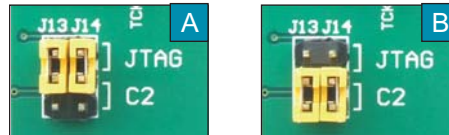

Figure 3-2: Position of jumpers 13 and 14

Figure 3-1: JTAG programmer

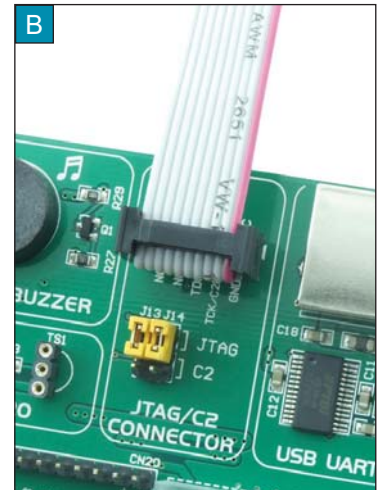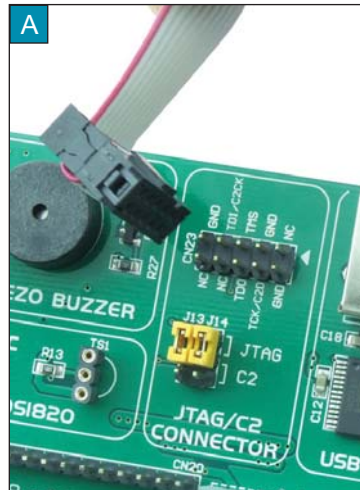**Figure 3-3**: Connector for programmer

Figure 3-4: Connecting JTAG programmer with the development system

4.0. Ethernet module

The Ethernet module enables the development system to access the LAN network via the RJ45 connector. The operation of the Ethernet module is in compliance with the IEEE 802.3 standard. Communication between this module and the microcontroller is performed via the Serial Peripheral Interface (SPI). In order to enable the Ethernet module to be connected to the microcontroller, switches 1, 3 and 5 (optionally 2, 4 and 6) on the DIP switch SW10 as well as switches 5, 6 and 7 on the DIP switch SW13 should be set to the ON position, Figure 4-3.
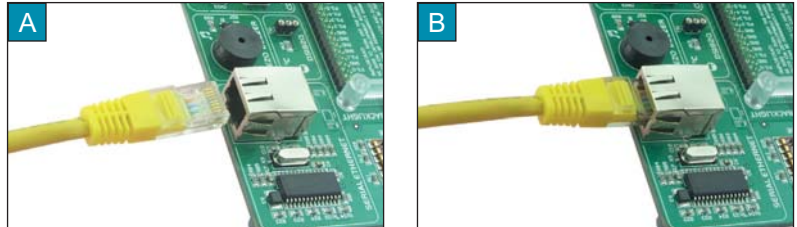

Figure 4-1: Ethernet module
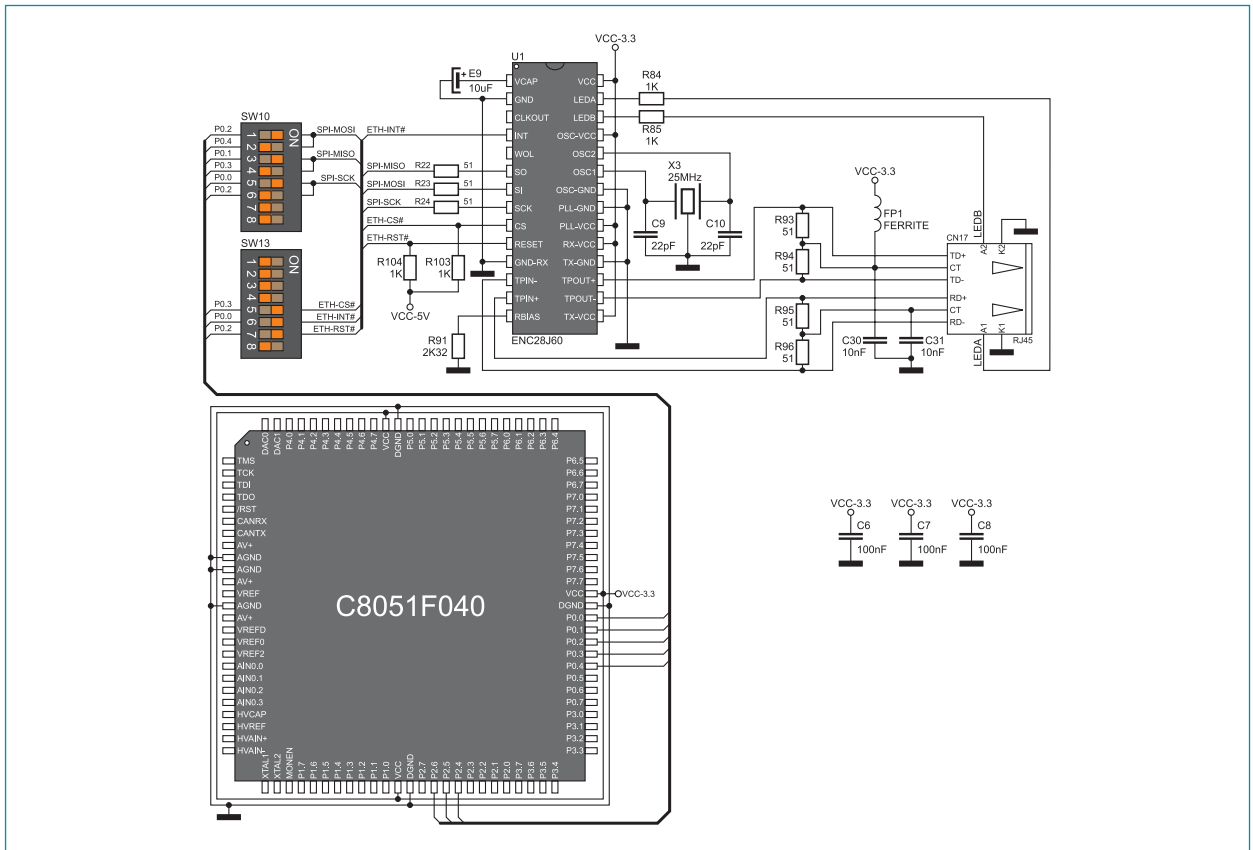

Figure 4-2: Connecting ethernet cable

Figure 4-3: Ethernet module connection schematic

5.0. Piezo buzzer

Due to a built-in piezo buzzer, the *BIG8051* development system is capable of emitting audio signals. In order to enable the piezo buzzer to operate properly it is necessary to generate a voltage signal of specific frequency. Remember, when writing this code, that the piezo buzzer's resonant frequency is 3.8kHz. Other frequencies in the range between 20Hz and 20kHz can also be used, but the best performance is provided with frequencies ranging between 2kHz and 4kHz. To establish connection between the piezo buzzer and the microcontroller, it is necessary to set switch 8 on the DIP switch SW13 to the ON position.

Figure 5-1: Piezo buzzer

Figure 5-2: Piezo buzzer connected to the microcontroller pin P2.7

Figure 5-3: Piezo buzzer and microcontroller connection schematic

6.0. DS1820 temperature sensor

1-wire® serial communication enables data to be transferred over one single communication line, while the process itself is under control of the *master* microcontroller. The advantage of this communication is that only one microcontroller pin is used. All *slave* devices have a unique ID code, which enables the *master* device to easily identify all devices sharing the same communication bus.

DS1820 is a temperature sensor that uses 1-wire communication for its operation. It is used to measure temperature in a range between -55 and 125°C and provides ±0.5°C accuracy for temperatures in a range between -10 and 85°C. The power supply voltage of 3V to 5.5V is used for the operation of this sensor. It takes maximum 750ms for the DS1820 to convert temperature with 9-bit resolution. There is a socket for this temperature sensor provided on the *BIG8051* development system. Communication between this module and the microcontroller is enabled via the microcontroller pin P2.7. To establish communication between them, it is also necessary to set switch 8 on the DIP switch SW15 to the ON position.

Figure 6-1: DS1820 connector (DS1820 is not connected)

Figure 6-2: Temperature sensor DS1820 is connected

NOTE:
Make sure that the rounded side of the DS1820 matches half-circle on the board

Figure 6-3: Switch 8 on the DIP switch SW15 is in ON position, DS1820 is connected to the P2.7 pin
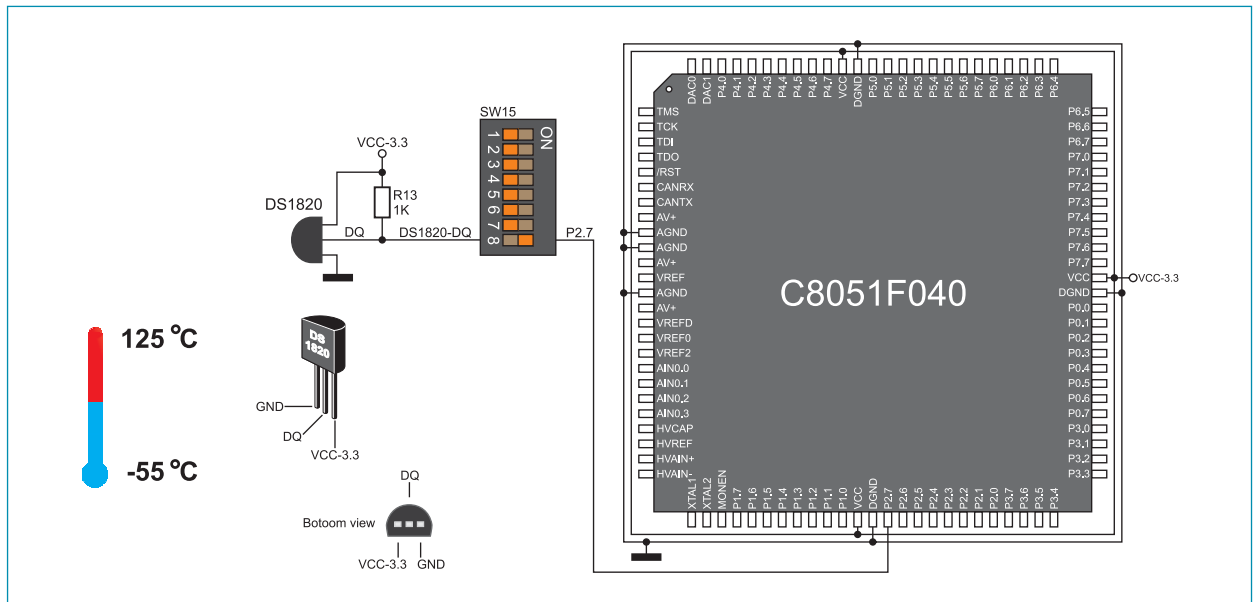

Figure 6-4: DS1820 and microcontroller connection schematic

7.0. USB UART module

The USB UART module is used to connect the microcontroller provided on the development system to external USB devices. In order to establish connection between the microcontroller and USB UART module, it is necessary to set switches 1 and 3 (optionally 2 and 4) on the DIP switch SW13 to the ON position. The *BIG8051* development system can also be powered via the USB connector for USB UART module. In this case, it is necessary to switch position of jumper J11 from EXT to USB.
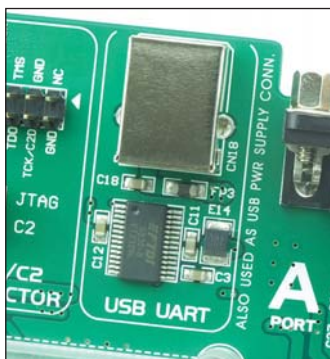

Figure 7-1: USB UART module
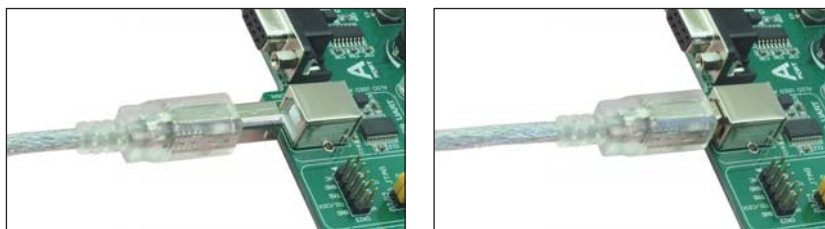
Figure 7-2: Connecting USB cable
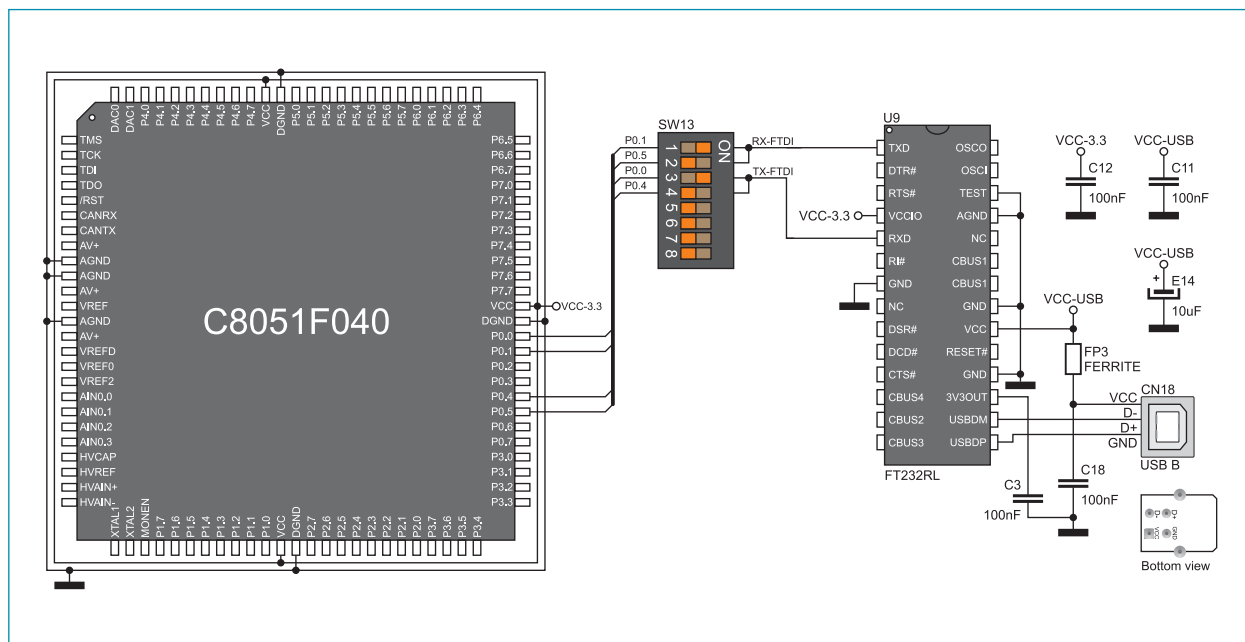
Figure 7-3: USB connector and microcontroller connection schematic

8.0. RS-232 modules

The RS-232 modules enable the development system to communicate to external devices whose operation is in compliance with the RS-232 standard. The *BIG8051* development system features two RS-232 modules that operate independently. To connect the RS-232A module and the microcontroller, switches 1 and 3 (optionally 2 and 4) on th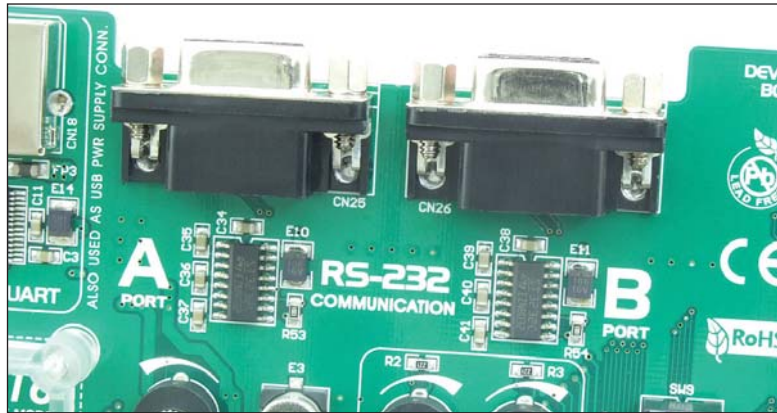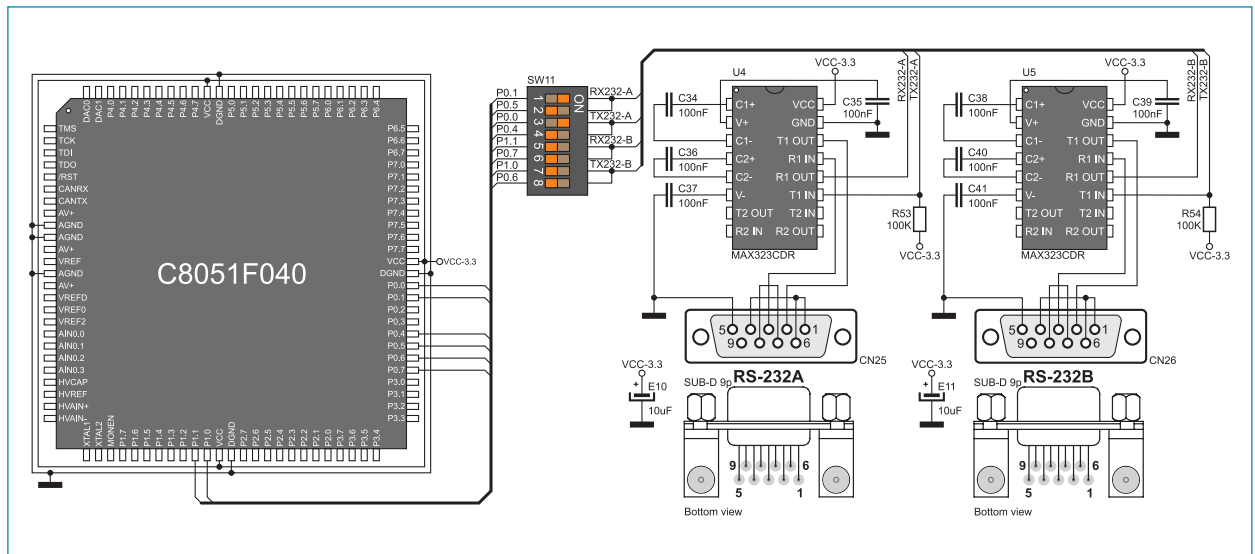e DIP switch SW11 should be set to the ON position. Similarly, to connect the RS-232B module and the microcontroller, switches 5 and 7 (optionally 6 and 8) on the DIP switch SW11 should be set to the ON position.

Figure 8-1: RS-232 module

Figure 8-2: RS-232 module connection schematic

9.0. CAN module

CAN (Controller Area Network) is a communication standard primarily intended for use in automotive industry. It enables the microcontroller to communicate to a device installed in cars without using a host PC. In addition, this communication is widely used in industrial automation. The *BIG8051* development system features CAN module used for communication with CAN devices. To establish connection between this module and the microcontroller, it is necessary to set switches 1 and 2 on the DIP switch SW12 to the ON position.

Figure 9-1: CAN module

Figure 9-2: CAN module connector

Figure 9-3: CAN module and microcontroller connection schematic

10.0. ZigBee module

The *BIG8051* development system enables you to connect the ZigBee module that is used for wireless communication. Communication between this module and the microcontroller is performed via the Serial Peripheral Interface (SPI). To enable communication between them, it is necessary to set switches 1, 3 and 5 (optionally 2, 4 and 6) on the DIP switch SW10, as well as switches 1, 2, 3 and 4 on the DIP switch SW15 to the ON position.

The operation of the ZigBee module is in compliance with the IEEE 802.15.4-2003 standard related to wireless data transfer on short distances with low-power consumption. The MRF24J40MA ZigBee modul is used on the *BIG8051* development system. Some of its key features are: up to 250kbps baud rate, 2.4GHz operating frequency, ~20mA power consumption, up to 400m coverage, etc.
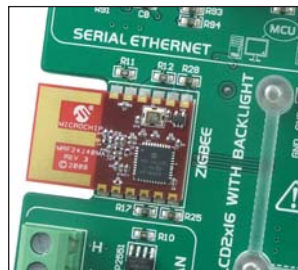
Figure 10-1: MRF24J40MA ZigBee module

Figure 10-2: Connector for ZigBee module
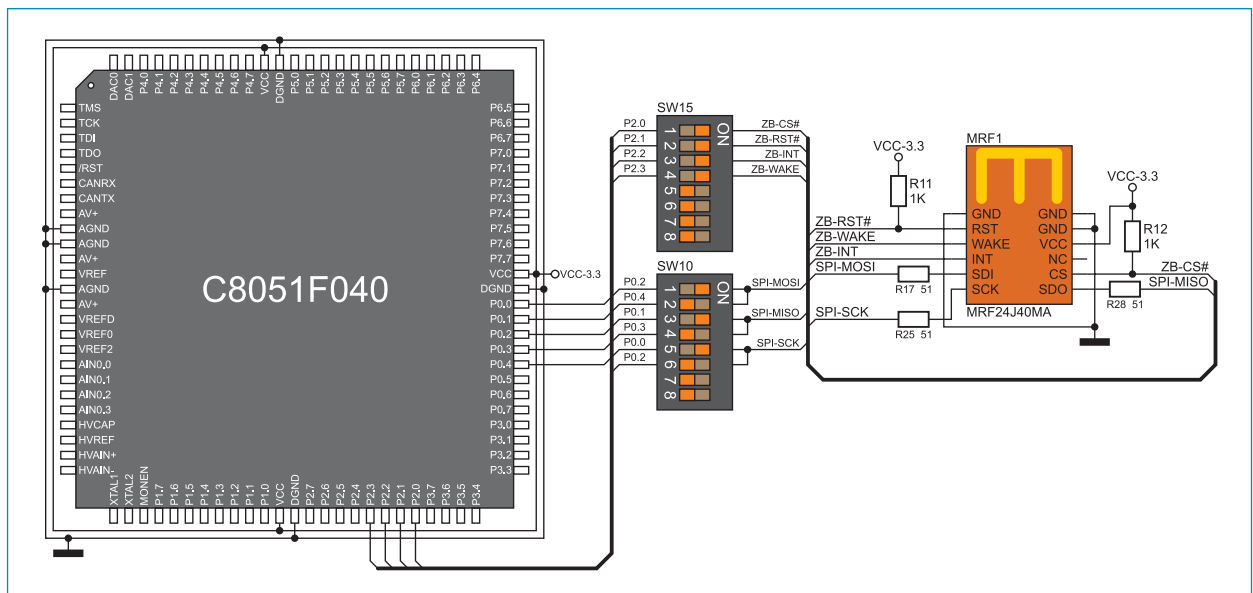
Figure 10-3: ZigBee module connection schematic

11.0. MMC/SD connector

The *BIG8051* development system is capable of reading memory cards due to the on-board MMC/SD connector. Memory card communicates with the microcontroller through the microcontroller pins used for serial communication. In order to establish connection between MMC/SD cards and the microcontroller, it is necessary to set switches 1, 3 and 5 (optionally 2, 4 and 6) on the DIP switch SW10, as well as switches 1 and 2 on the DIP switch SW14 to the ON position.
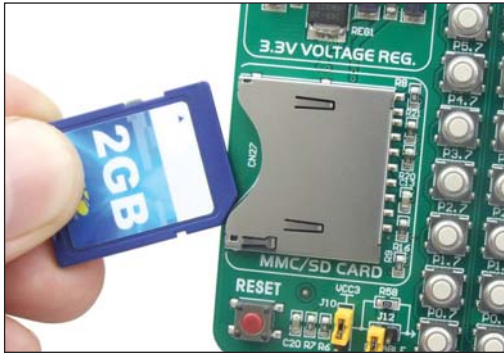
Figure 11-1: MMC/SD memory card
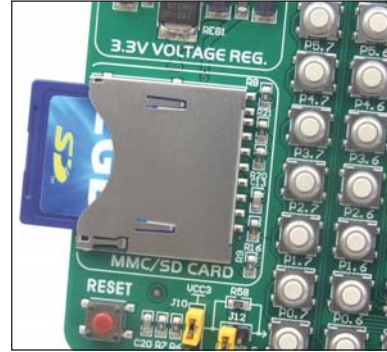
Figure 11-2: MMC/SD connector
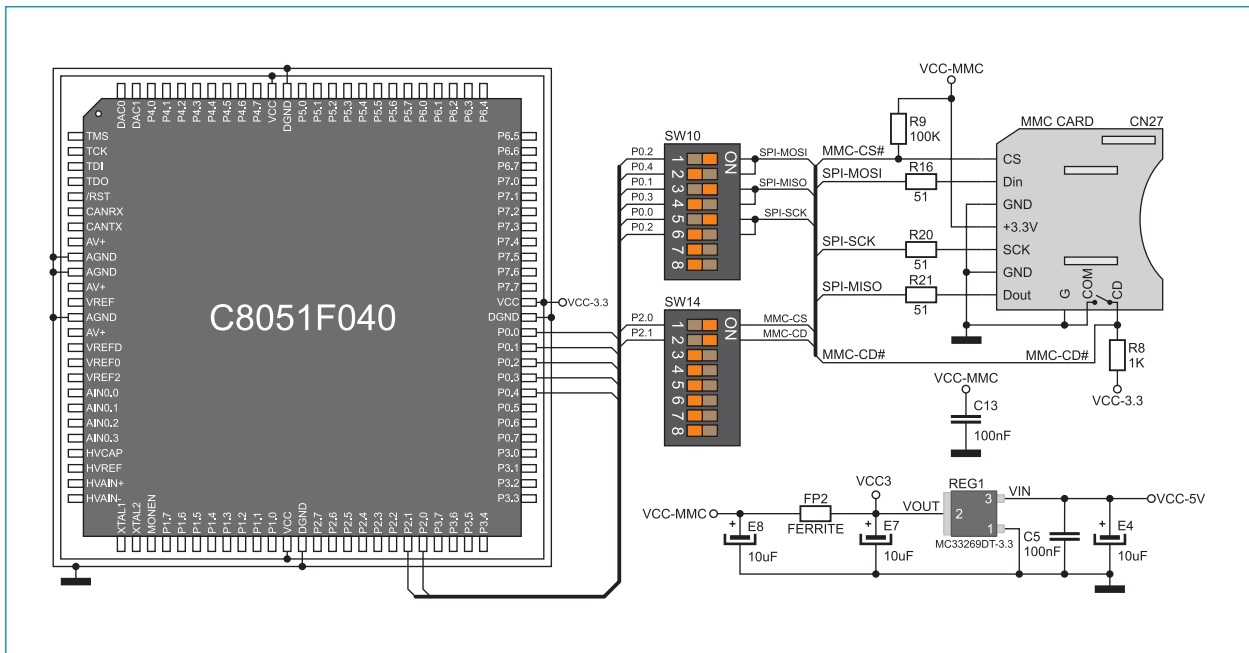
Figure 11-3: MMC/SD connector and microcontroller connection schematic

12.0. Comparator

The *BIG8051* development system is capable of comparing voltage levels due to a comparator built into the microcontroller. Voltage signals are supplied via potentiometers P5 and P6. In order to enable voltage signals, to be compared, to be supplied to the microcontroller, it is necessary to set switches 5 and 6 on DIP switch SW15 to the ON position.
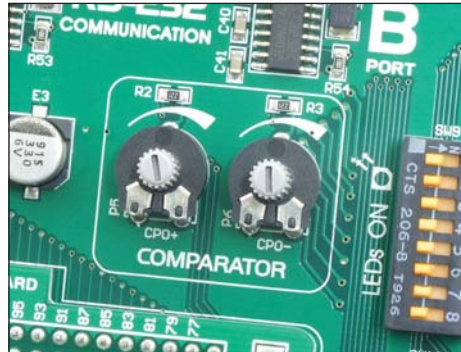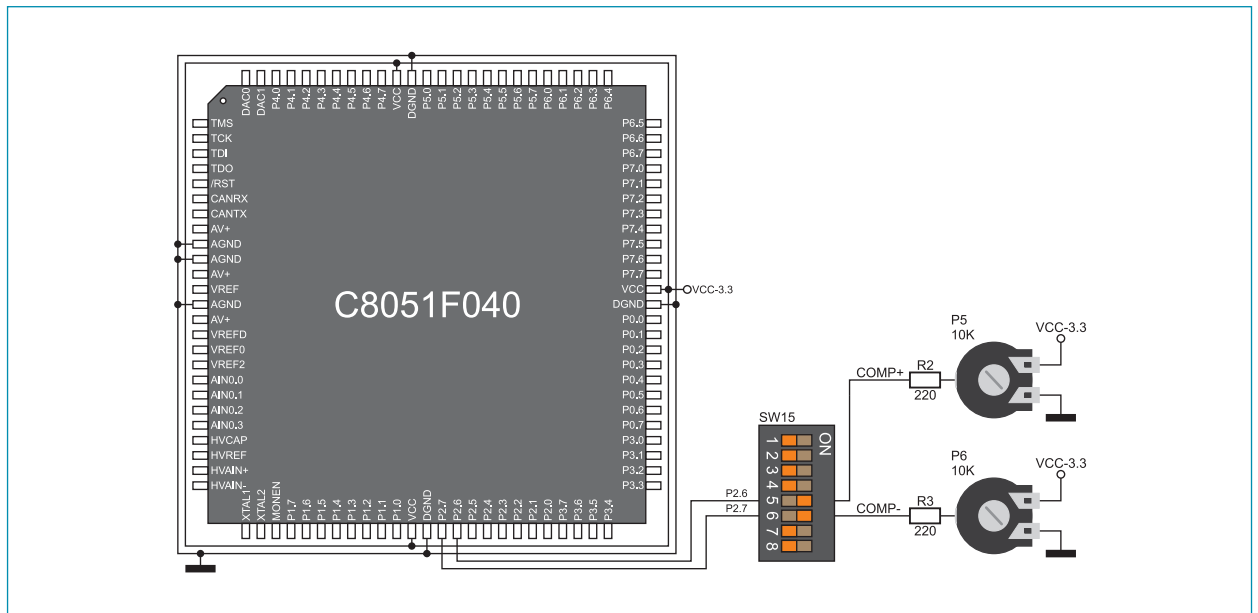

Figure 12-1: Comparator

Figure 12-2: Comparator connection schematic

13.0. ADC module

The ADC module is used to convert an analog voltage level into the appropriate 12-bit digital value. The analog voltage signal is supplied via screw terminals CN15 and CN16. The ADC module is built-in into the microcontroller. The voltage supplied from the VREF pin is used as a voltage reference. In order to use this voltage, switch 8 on the DIP switch SW14 should be set to the ON position.
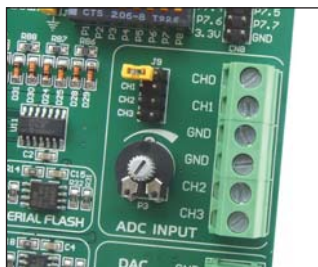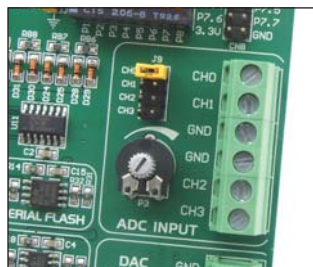

Figure 13-1: ADC module

Figure 13-2: Jumper J9

If the voltage, necessary to perform A/D conversion, is not supplied from an external source, then the 3.3V power supply voltage is used. In this case, it is necessary to place jumper J9 on the appropriate pins, Figure 13-2.
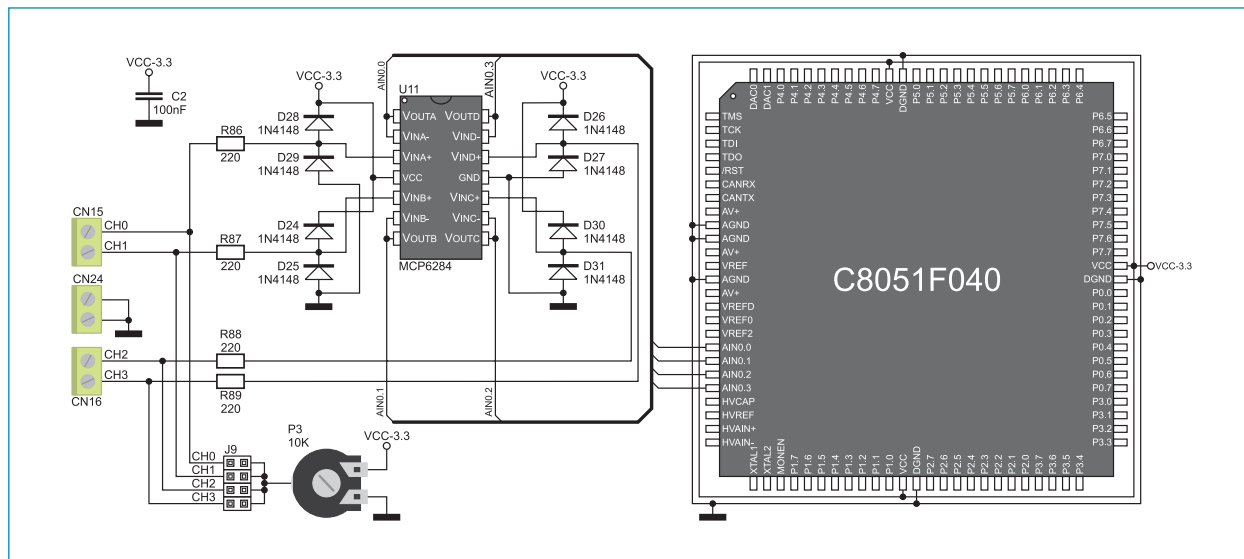
Figure 13-3: ADC module connection schematic

14.0. DAC module

A DAC module is used to convert 12-bit digital values into appropriate analog voltage values. The analog voltage signal is delivered via screw terminals CN13 and CN14. The DAC module is built into the microcontroller. The voltage supplied from the VREF pin on the microcontroller is used as a voltage reference. To enable the use of this voltage, switch 7 on the DIP switch SW14 should be set to the ON position.
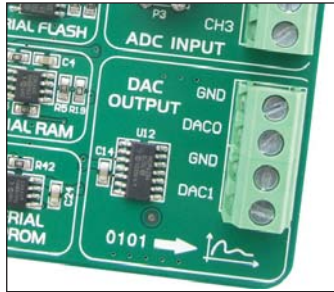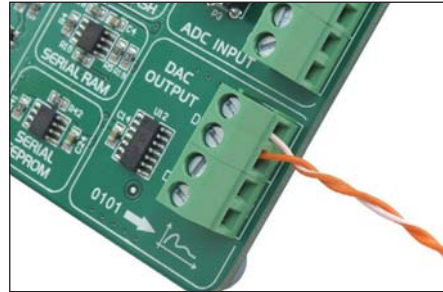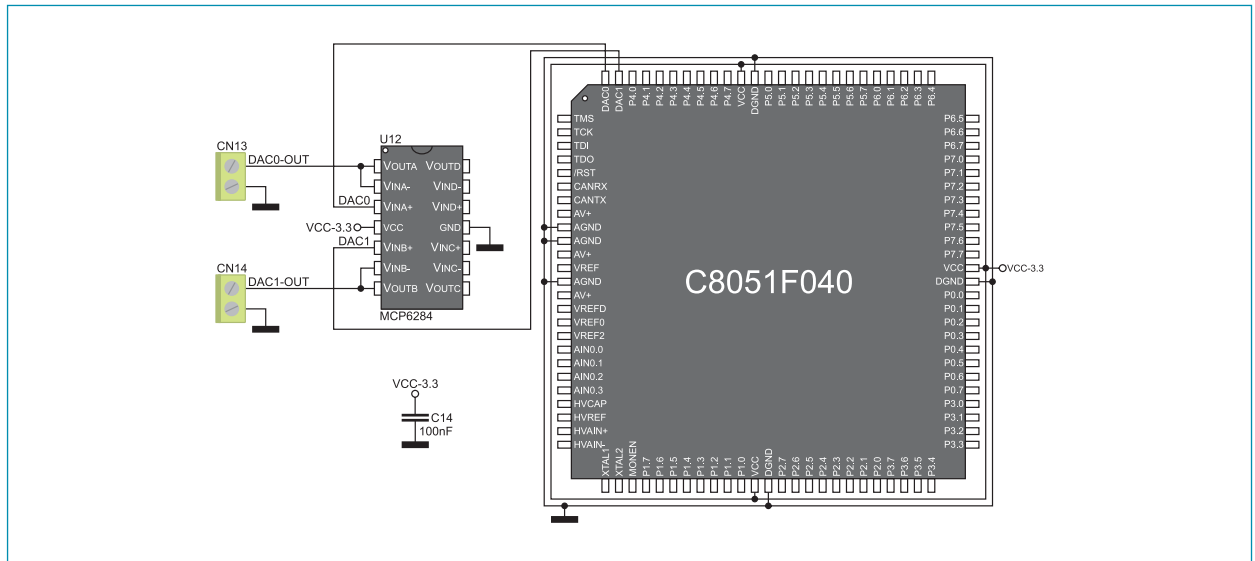

Figure 14-1: DAC module

Figure 14-2: DAC module connector

Figure 14-3: DAC module connection schematic

15.0. Memory modules

The *BIG8051* development system features Flash, RAM and EEPROM memory modules. These modules enable the microcontroller to expand its memory space.
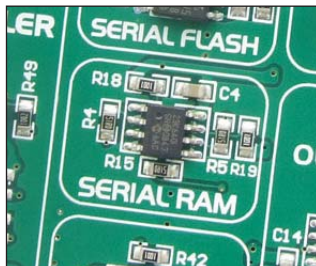

Figure 15-1: Flash module

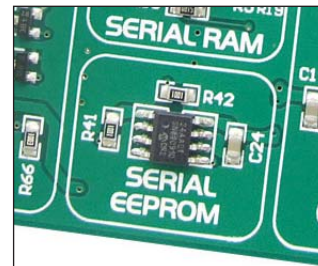**Figure 15-2**: RAM module

Figure 15-3: EEPROM module

Flash module enables the microcontroller to use additional 8Mbit flash memory via the Serial Peripheral Interface (SPI). To establish connection between this module and the microcontroller, it is necessary to set switches 1, 3 and 5 (optionally 2, 4 and 6) on the DIP switch SW10, as well as switch 7 on the DIP switch SW15 to the ON position.
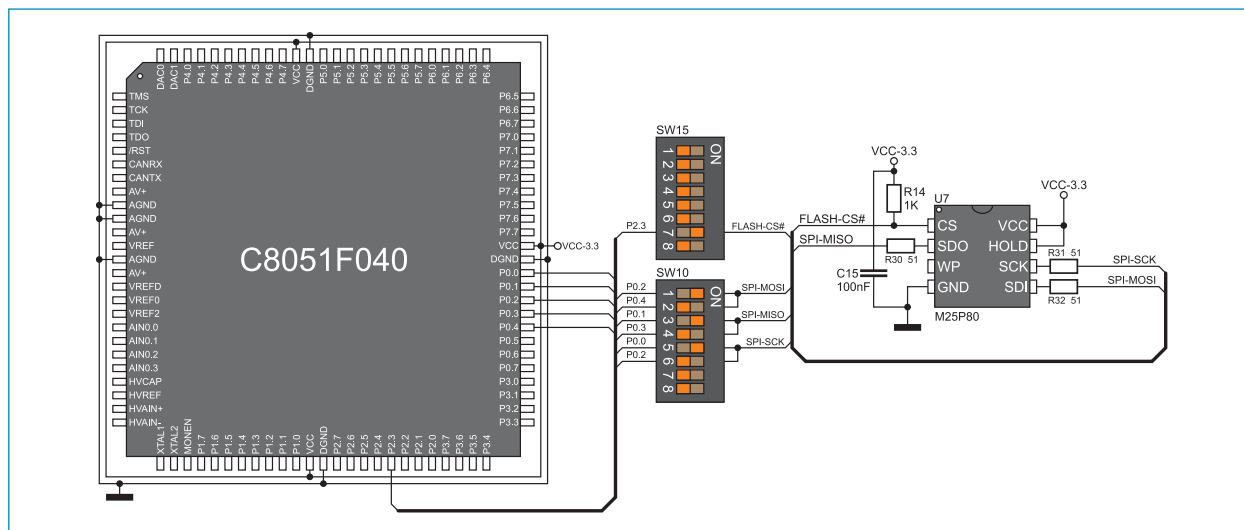

Figure 15-4: Flash module connection schematic

RAM module enables the microcontroller to use additional 64Kbit RAM memory via the Serial Peripheral Interface (SPI). To establish connection between this module and the microcontroller, it is necessary to set switches 1, 3, 5, 7 and 8 (optionally 2, 4 and 6) on the DIP switch SW10 to the ON position.
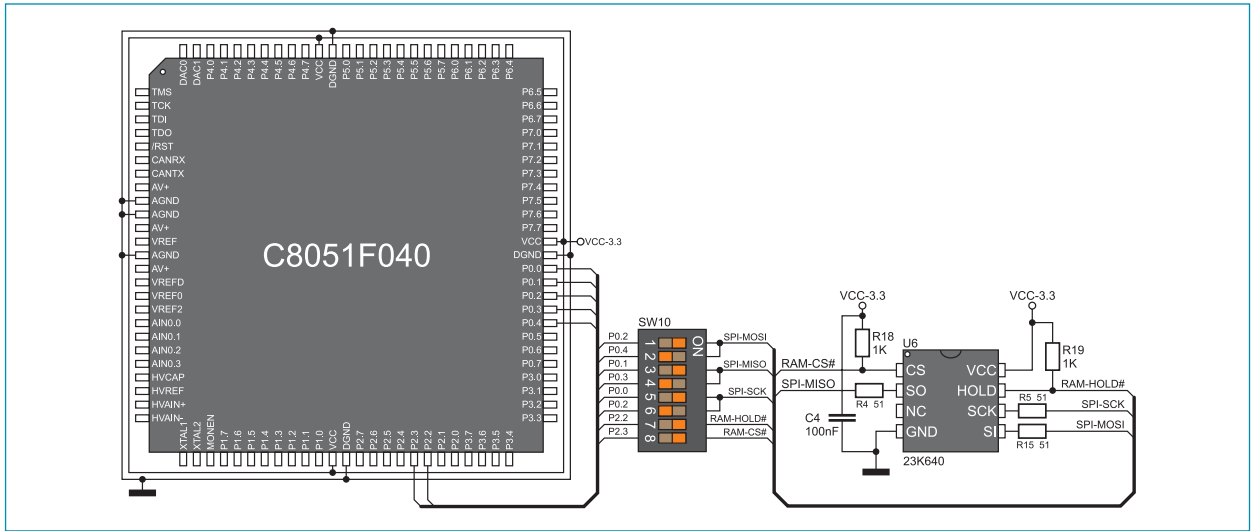

Figure 15-5: RAM module connection schematic

EEPROM module enables the microcontroller to use additional 1Kbit EEPROM memory via I2C serial connection. To establish connection between this module and the microcontroller, it is necessary to set switches 3 and 5 (optionally 4 and 6) on the DIP switch SW12 to the ON position.
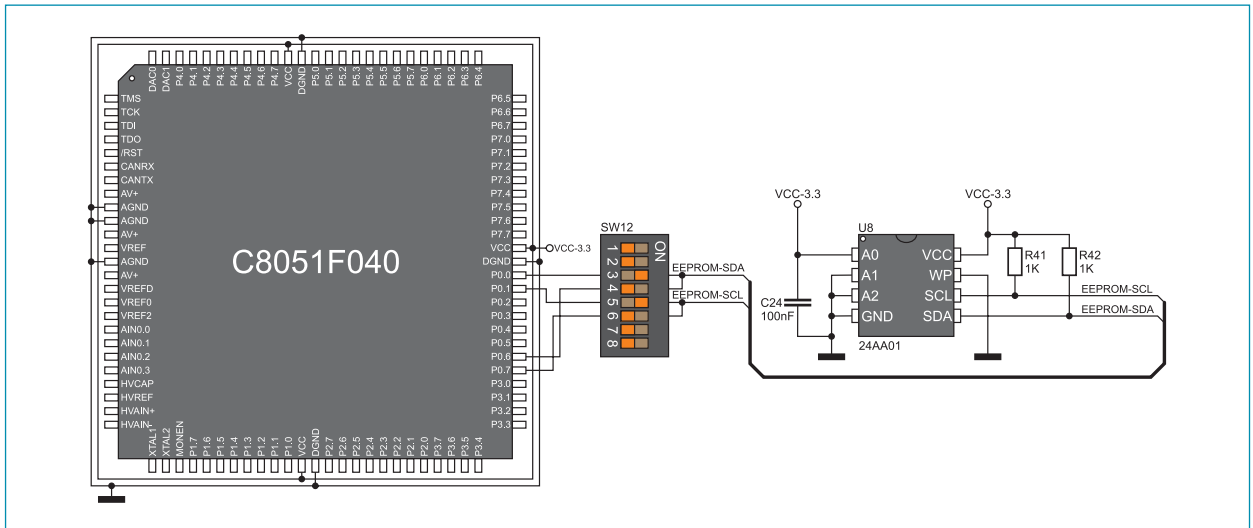

Figure 15-6: EEPROM module connection schematic

16.0. LEDs

There are 64 LEDs on the *BIG8051* development system used to visually indicate the state of each microcontroller I/O pin. An active LED indicates that a logic one (1) is present on the pin. In order to enable LEDs to illuminate, it is necessary to select the appropriate port ((PORT0, PORT1, PORT2, PORT3, PORT4, PORT5, PORT6 or PORT7) using DIP switch SW9.
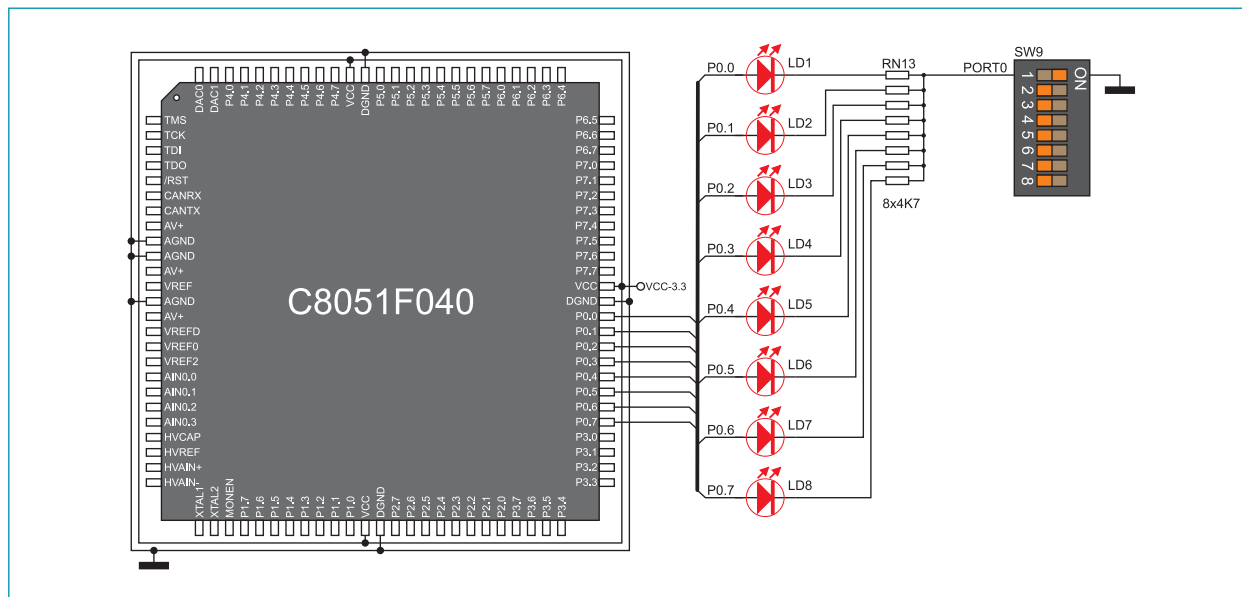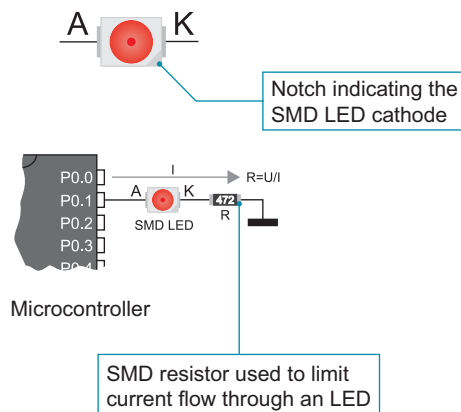

Figure 16-1: LEDs

Notch indicating the SMD LED cathode

Microcontroller

SMD resistor used to limit current flow through an LED

Figure 16-2: LED and port PORT0 connection schematic

17.0. Push buttons

The logic state of all microcontroller input pins may be changed by using push buttons. Jumper J10 is used to determine the logic state to be supplied on the appropriate microcontroller pin by pressing a push button. The function of the protective resistor is to limit the maximum current, thus preventing the development system and peripheral modules from being damaged in case a short circuit occurs. If needed, advanced users may shorten this resistor using jumper J12. Right next to the push buttons, there is a RESET button used to reset the microcontroller.

Figure 17-1: Push buttons

By pressing any push button when jumper J10 is in the VCC position, a logic one (3.3V) will be applied to the appropriate microcontroller pin, as shown in Figure 17-2.
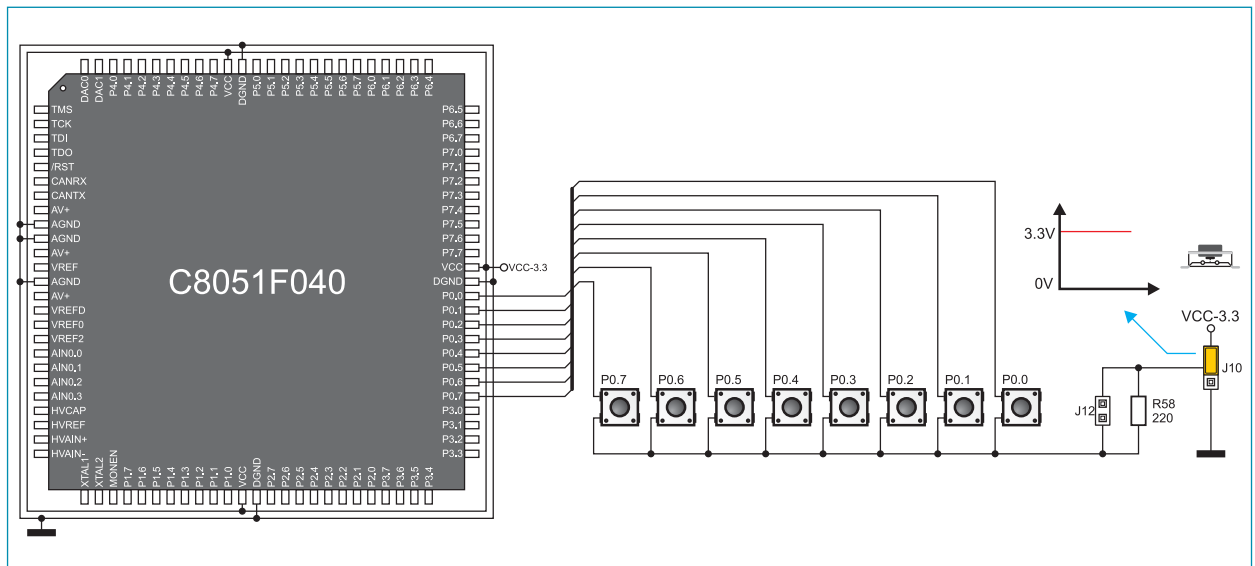

Figure 17-2: Push buttons and port PORT0 connection schematic

18.0. 2x16 LCD display

The *BIG8051* development system features an on-board connector for the alphanumeric 2x16 LCD display. This connector is linked to the microcontroller via port PORT3. Potentiometer P1 is used to adjust display contrast. The LCD-BCK switch on the DIP switch SW12 is used to turn the display backlight on/off.

Communication between this LCD and the microcontroller is performed in a 4-bit mode. Alphanumeric digits are displayed in two lines each containing up to 16 characters of 7x5 pixels.

Figure 18-1: Connector for alphanumeric LCD display

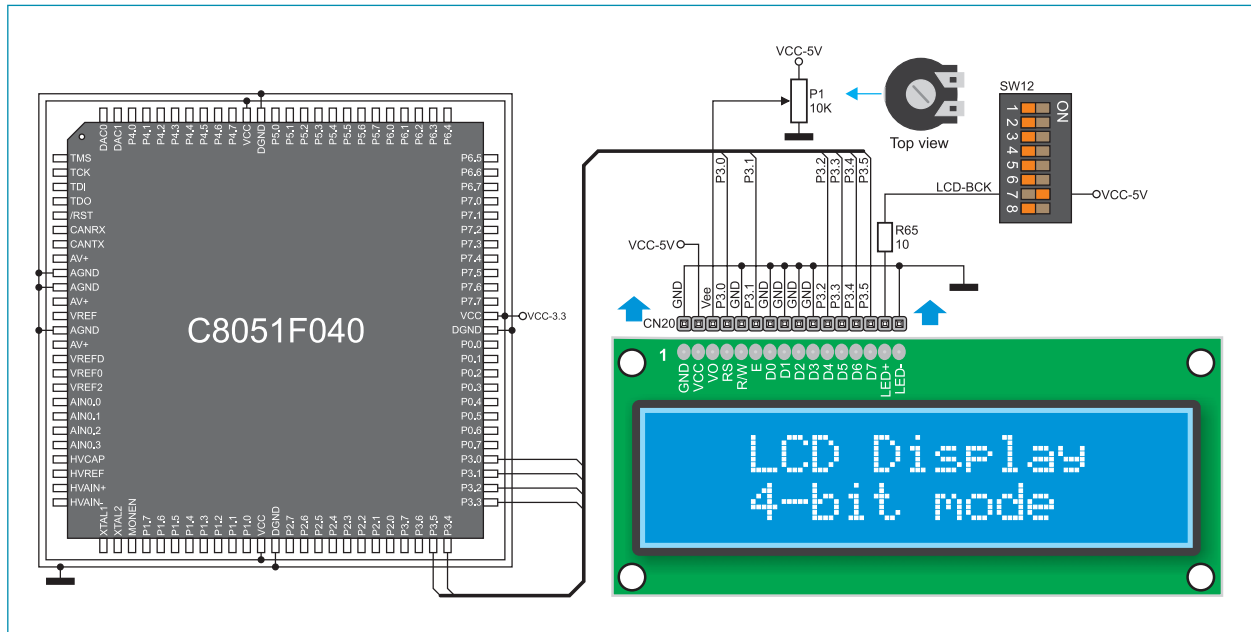**Figure 18-2**: Alphanumeric 2x16 LCD display

Figure 18-3: 2x16 LCD display connection schematic

19.0. 128x64 graphic LCD display

128x64 graphic LCD (GLCD) is connected to the icrocontroller via PORT2 and PORT4 ports and enables graphic content to be displayed. It has a screen resolution of 128x64 pixels, which allows diagrams, tables and other graphic contents to be displayed. Potentiometer P1 is used for the GLCD display contrast adjustment. Switch 8 (GLCD-BCK) on the DIP switch SW12 is used to turn the display backlight on/off.
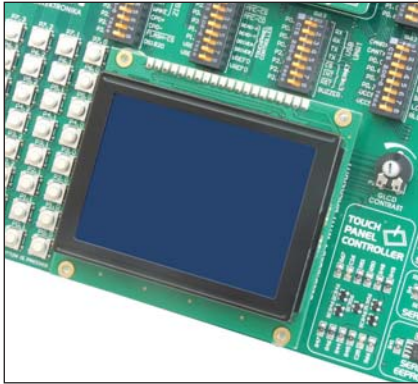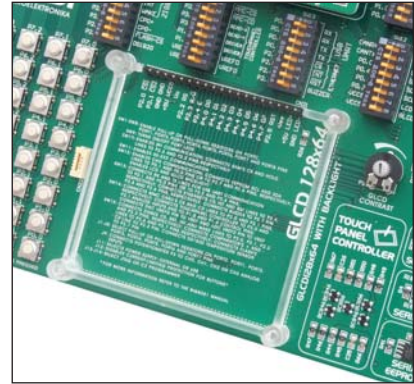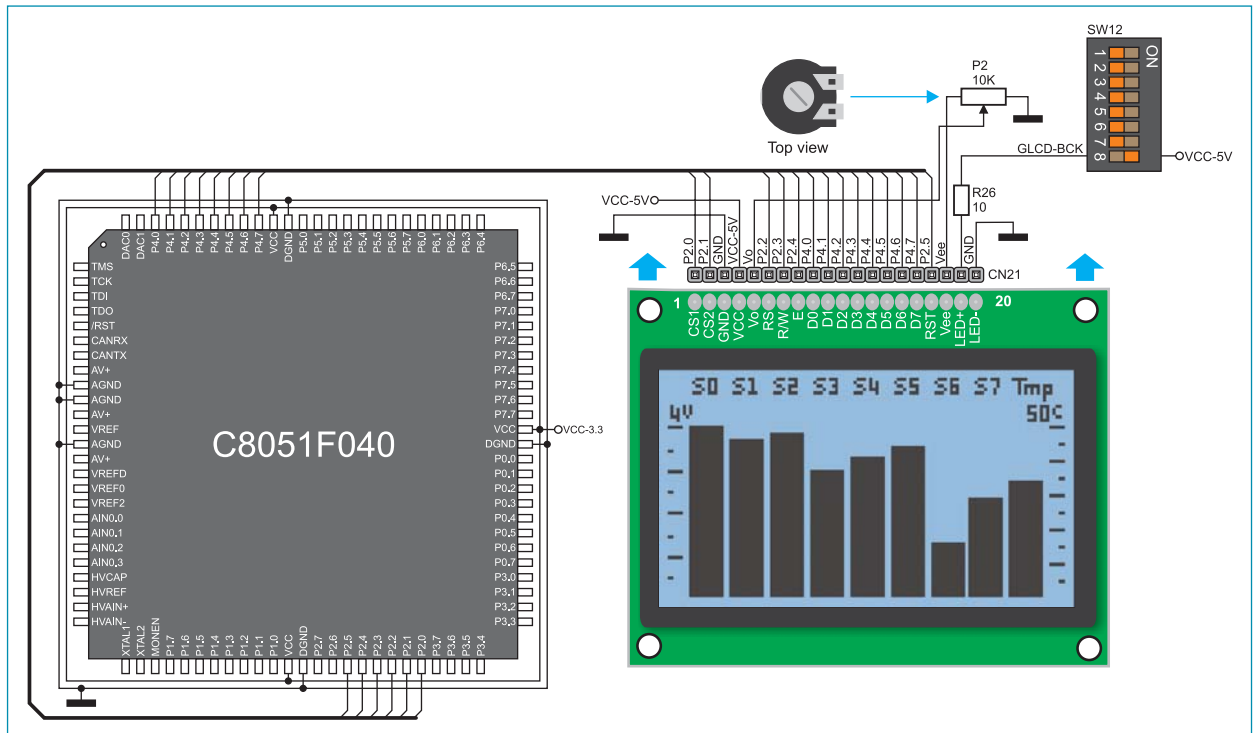

Figure 19-1: GLCD display

Figure 19-2: GLCD connector

Figure 19-3: GLCD display connection schematic