# Terasic DE10-Standard CycloneV FPGA board

The user manual for the DE10-Standard board is the best resource for determining how to use the features on the board. This manual is included in the documentation found in the DE10-Standard CD-ROM_ image. You can find this files, as well as the board schematic, or by going into the course Canvas page, Files > Reference Material > DE10_Standard, or by creating an account at http://www.terasic.com and downloading the files.

The image below shows the many features of the board, most of which will not be used during this class. Some of the features we will use require digging into the user manual and schematics for details. To clarify some of these details, this document will point out certain things needed for the course. **All descriptions are based on the orientation of the board in the image below (VGA connector at the top).**
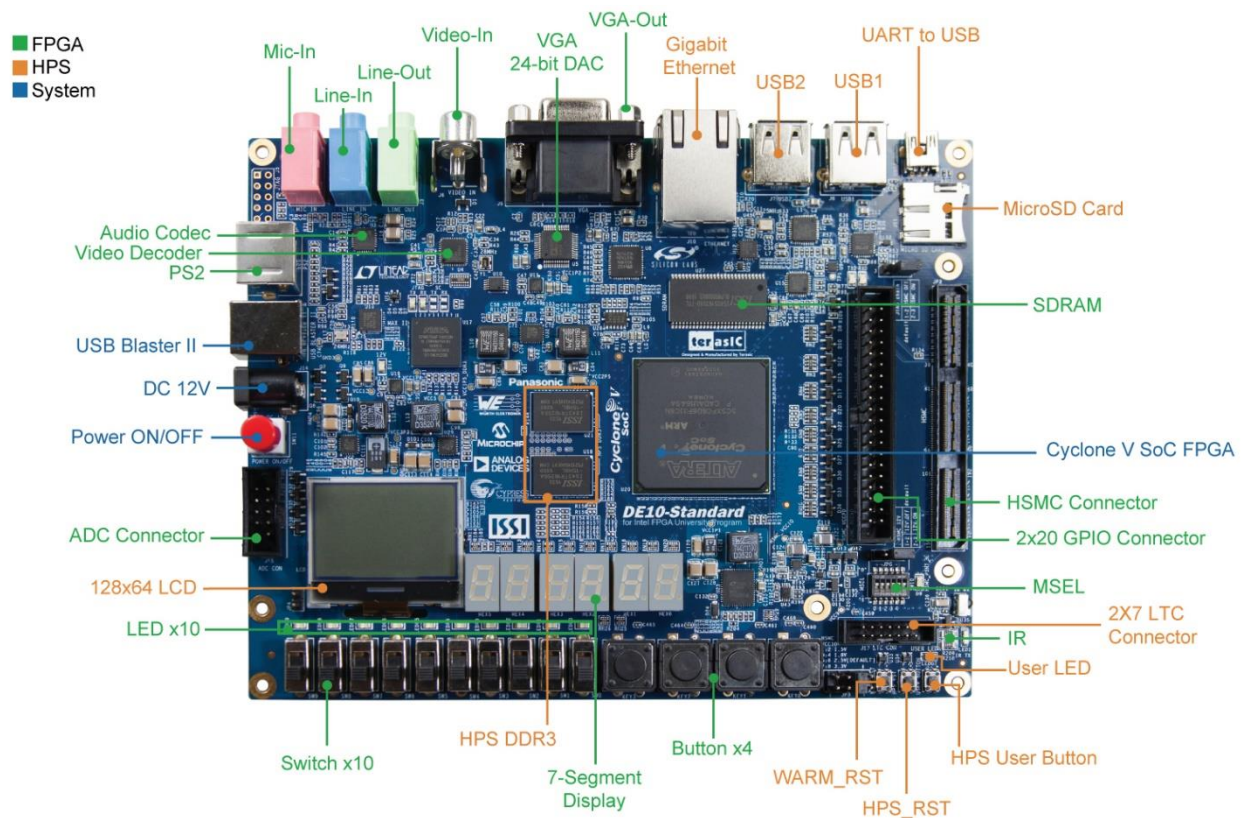
1. **MSEL settings for correct configuration**

   The tiny 6 position DIP switch labeled MSEL in lower right corner of the board should be set as follows (from left to right): up down up up down up

   The switches should be set correctly when you receive the board. If you have any problems with configuration downloads to the board, check these switches first.

2. **Quartus Programmer Setup**

The specific CycloneV part number is 5CSXFC6D6F31C6N. When you program the FPGA using the Quartus programmer, you should see this number for the selected FPGA device. For a new project, the programmer will open a pop up window asking for the specific device – in this case, you select the next to last device number, which is 5CSXFC6D6.

3. **Board Jumpers**

You should not modify the jumpers on the board, they are set properly.

The LCD in the lower left is backlit by default. This display will not be used in this class, as only the processor subsystem can access the LCD. There is a 2 pin jumper block at the lower left corner of the display. Per the manual, adding a jumper should turn off the blue backlight. I found adding the jumper had no effect. If you want to turn off the backlight, you can try adding a jumper (find another jumper and don't change any existing jumpers), but don't be surprised if the backlight stays on.

   a) J3 - just to right of KEY[0], controls voltages to HSMC connector. Pin 1 is lower left, pin 7 is lower right, pin 2 is upper left, pin 8 is upper right. Default jumper is pins 5 to 6
   b) J4 - backlight for LCD, lower left of LCD. No jumper is backlight on, jumper is backlight off
   c) J5 - just below SD card connector, jumper between pins 1 and 2 (two rightmost pins) to not include the HSMC connector in the JTAG chain
   d) J6 - just below the GPIO connector, jumper between pins 1 and 2 (two rightmost pins) to not supply +12v to HSMC connector

4. **GPIO Connector**

The 2x20 pin GPIO connector (40 pins total) can be used in the class to connect signals to your Analog Discovery module, if you have one. The assignment of the pins below correspond to the default naming provided in the Quartus .qsf system files generated using the Terasic SystemBuilder tool. By assigning a signal in your top level Verilog project file to a GPIO pin, you can access that signal on the GPIO connector. Notice that the 2x20 connector contains an alignment slot on the left side of the connector.

   a) Upper left pin (connector side with center slot) is pin 1, and the bottom left pin is pin 39. The pins on the left side of the connector are odd numbers
   b) Upper right pin is pin 2, and the bottom right pin is pin 40. The pins on the right side of the connector are even numbers
   c) Pin 11 is +5v, Pin 29 is +3.3v, pins 12 and 30 are grounds
   d) GPIO[0] through GPIO[9] are connected to pins 1-10
   e) GPIO[10] through GPIO[25] are connected to pins 13-28

f) GPIO[26] through GPIO[35] are connected to pins 31-40

For example, if you assigned a signal to GPIO[10] in your top level Verilog file, that signal would be accessible on the GPIO connector at pin 13. Pin 13 is on the left side of the connector, and is the 7th pin from the top, on the left side of the connector.

Note: Whenever you connect the Analog Discovery module to the GPIO connector, you must attach a ground lead from the Analog Discover module to a ground pin on the GPIO connector (either pin 12 or pin 30).

5. **7 segment displays**

a) The leftmost 7 segment display is HEX5, the rightmost display is HEX0
b) The decimal points are not connected, only the 7 segments can be driven, this is different than the DE10-Lite board.

6. **Big pushbuttons**

a) KEY[3] is leftmost button, KEY[0] is rightmost button

7. **Switches and LEDs**

a) SW[9] is the leftmost switch, SW[0] is the rightmost switch
b) LEDR[9] is the leftmost LED, LEDR[0] is the rightmost LED

8. **ADC (Analog to Digital Convertor) connector**

Note: The diagram for the ADC connector shown below (from the DE10-Standard User Manual shows the ADC connector **<u>upside down</u>**. With the board oriented with the VGA connector at the top, this diagram should be rotated 180 degrees.

For this reason, use the connector pin number described in the text below.
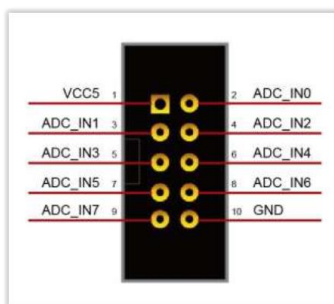
The ADC connector is the 2 x 5 connector just below red power button on the left side of the board. The pin numbering of the ADC connector is different than the GPIO connector.

a) Pin 1 is the bottom right pin (on side with slot), connected to +5v.
b) Pin 9 is the top right pin (on side with slot).
c) Pin 2 is the bottom left pin (near edge of board).
d) Pin 10 is the top left pin, connected to ground (near edge of board).
e) Inputs ADC_IN0 through ADC_IN7 are pins 2-9.