CMOSexod

Post-It Board Users Manual V1.1

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Revision History:

rev 1.0 - 2/2000 - Initial version
rev 1.1 - 4/2001 - Updated to reflect changes in Post-It version 2.

1.0 Welcome

Welcome to the exciting world of programmable logic ! You will find Post-It a very capable yet fun board to trust all of your designs. Post-It board allows you to turn your designs in to a lasting ones. Due to its economical cost, you no longer have to share a single evaluation board for multiple designs. Get as many Post-Its boards as you need, one for each of your fun designs.

In order to get started with you new Post-It board you will need the following:

- E+Max Development Software
- ByteBlaster Parallel Port Download Cable or ByteBlasterClone
- Power Supply
- Post-It board

The E+Max Development Software can be freely downloaded from Altera's website. This software allows design entry in Verilog, VHDL or in schematics. For further information and downloads visit Altera's website, www.altera.com Once you download the software, you need to obtain a license to enable the software. This process is done electronically via email and takes less than 10 minutes.

The ByteBlaster download cable connects your Post-It board to the PC's parallel port (printer port). The E+Max software communicated to the target CPLD/FPGA device through this cable. The download cable contains a CMOS buffer (HC244), allowing target CPLD/FPGA devices to be programmed at varying voltage levels.

2.0 Quick Feature Outline

Your new Post-It board contains several features and options which makes it ideal all the way from novice designers to seasoned engineers.

*Your Post-It is **Capable***:

- Uses 1 CMOS-EEPROM based EPM3128A CPLD in 100 pin TQFP package. This CPLD contains 2500 useable gates with 128 macrocells.
- You can run your designs at up to 125MHz.
- You can reprogram the CPLD for as many times you desire.

*Your Post-It is **Expandable**:*

- 65 pins out of 73 non-committed I/O pins are brought out to 4 edge connectors for expansion. You can connect multiple Post-It with a standard ribbon cable if you need more logic space.
- A male DB-9 connector allows RS-232 communications between Post-Its.

*Your Post-It **contains all the Basic I/Os**:*

- Large 4 digit 7-segment display serves as general purpose output for most designs.

- An 8-input DIP Switch serves as general purpose input for most designs.
- A reset switch connected to GCLRn pin of CPLD provides synchronous or asynchronous reset.

*Your Post-It is **ready to go out of the box**:*

- An onboard thermal sensor, LM75, allows Post-It to become a digital thermometer.
- Your Post-It comes with a number of designs ready to be downloaded into the CPLD. Start having fun the second you unpack it.

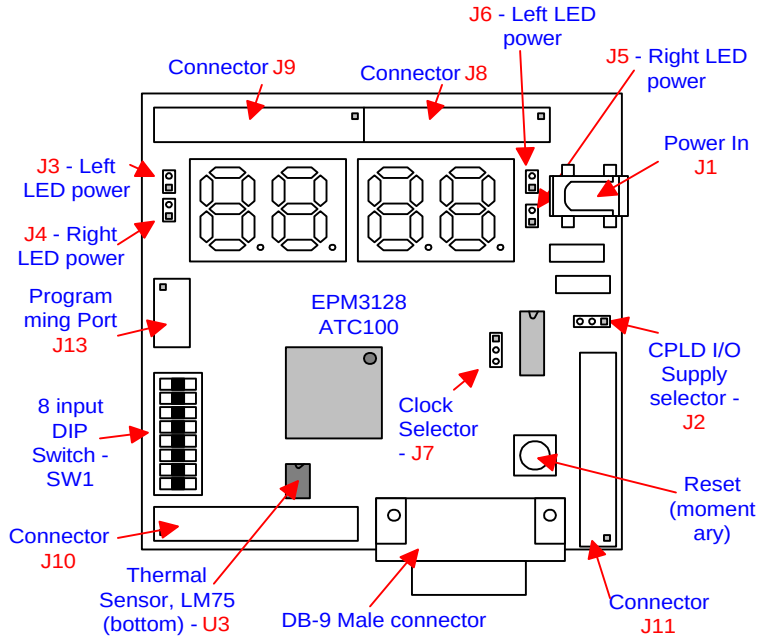
*Your Post-It is **Power Friendly**:*

- Two on-board clock sources feed each of the GCLK inputs of the CPLD.
- A separate I/O power connector allows 2.5V, 3.3V or 5.0V to be used as I/O supply.
- Each of the 4 7-segment displays can be disabled for low-power operation.

2.0 Getting to Know your Post-It Board

Before you start working with Post-It board, take a moment to explore all of its options and features. This will allow the optimum usage for each of your projects. Figure 1 illustrates the options and features of the board

Figure 1 Post-It Board Connector and Jumpers



2.1 Getting to Know you Options

Tables 1 through 4 describes the configurable options available on the Post-It board. Most of these are configured through jumpers.

Table 1 : Connector J1 - Main Power Connector

This is main power to the Post-It. It feeds the LED displays as well as the EPM3128 CPLD's internal VCC. Since all of the required voltage regulators are built-in to the board, any DC power supply which can provide 6V to 12V at 300mA can be used. A 2.0mm power connector is used.

Inside Pin 2.0mm	VCC
Outside	GND

Table 2 : Jumper J2 - CPLD I/O Power Selector

This jumper selects the I/O supply of the EPM3128 CPLD. By shorting pins 1 and 2, a 5.0V is used for the CPLD I/Os. By shorting pins 2 and 3 a 3.3V. Other I/O voltage can be used simply by supplying it to Pin 2. Allowable voltages are 2.5V, 3.3V and 5.0V.

Pin 1 (right, square)	5.0V
Pin 2 (middle, round)	CPLD I/O VCC. Allowed voltages: 2.5V, 3.3V, 5.0V
Pin 3 (left, round)	3.3V

Table 3 : Jumper J7 - GCLK1 Clock Selector

This jumper controls the clock source to GCLK1 of the CPLD. There are 2 clock generators on the board:

(1) Slow clock. This clock is generated from RC and schmidt trigger inverters. Values of R5 and C1 sets the clock rate. Typical clock is set to 200Hz.
(2) Fast clock. This clock is generated from a clock oscillator located on the solder side (bottom) of the PCB. Typical clock oscillator used is 33.333MHz.

Jumper Setting	*Selected GCLK1 Source*
1&2 (jumper top)	Fast Clock 33.333MHz
2&3 (jumper bottom)	Slow Clock 200Hz

Table 4 : Jumper J3 - J6 - LED Display Power

Jumpers J3 through J6 controls the power to the 7-segment LED displays. When the jumper is inserted, the corresponding 7-segmnt display is powered on.

Jumper	*Effect*
J3	Controls the left digit, of the left display.
J4	Controls the right digit, of the left display.
J5	Controls the left digit, of the right display.
J6	Controls the right digit, of the right display.

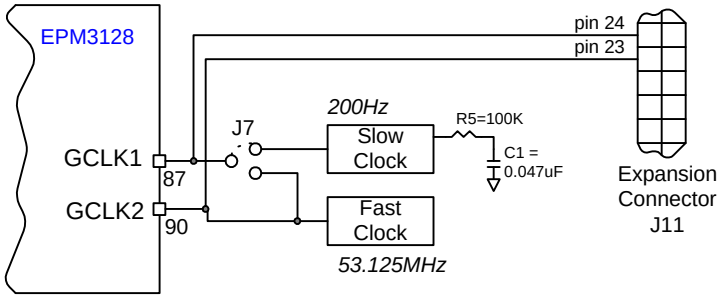
2.2 Getting to know your Features

Post-It board contains a number of features most commonly used in typical application, which makes It ideal as ready-to-go board for a variety of projects.

2.2.1 Clock Structure

Your Post-It board uses a simple, but yet flexible and expandable clocking structure. As mentioned in Table-3, there are two on-board clock sources. The slow clock is built from an RC based oscillator. Typical frequency is 200Hz. R5 and C1 controls the frequency, and the default values are 100Kohm and 0.047uF, respectively. The fast clock is generated by a Crystal Oscillator. It is located on the bottom (solder side) of the PCB and typical frequency is 53.125MHz. Actual clock frequency setting may vary, so be sure to verify it on your own board.

Figure 2 Post-It Clocking Structure



Refer to figure 2. The Altera EPM3128 CPLD supports two dedicated clock input pins. *For more information on dedicated clock input pins, refer to the EPM3128 specification*. The GCLK1 clock input can be sourced from either the slow or the fast clock. The GCLK2 clock input is sourced directly from the fast clock.

Note that both GCLK1 and GCLK2 clocks are also brought to the Expansion Connector J11, pins 24 and 23, respectively. This allows one Post-It board to supply clocks to a second Post-It board. Alternatively, by leaving J7 unjumpered, it is possible to supply a very different clock to GCLK1 through pin24 of J11.

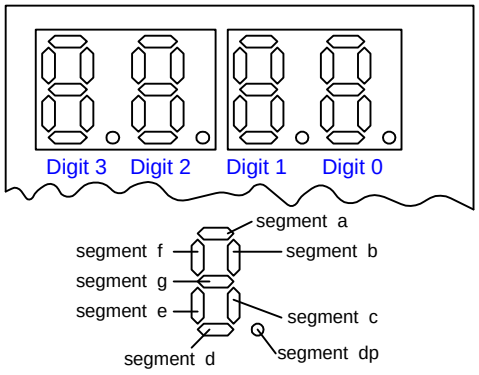
2.2.2 Seven Segment Display

Your Post-It board contains a large display suitable for most projects. It consists of four digit 7-segment red LED display. This display serves as the main output of the board.

Each one of the four digits can be enabled or disabled using jumpers J3 through J6. This allows a low power operation, when the display is not needed.

Figure 3 illustrates the assignment of the digit, as well as the ordering of the digits.

Figure 3 Labeling of 7-segment LED display



Each one of the display pins are also brought out to Expansion Connectors J8 and J9. Table 1 summarizes the connections to the connector.

segment	CPLD pin	Connector/Pin	segment	CPLD pin	Connector/Pin
led0_a	1	J8/6	led2_a	22	J9/6
led0_b	2	J8/5	led2_b	23	J9/5
led0_c	5	J8/8	led2_c	24	J9/8
led0_d	6	J8/7	led2_d	25	J9/7
led0_e	7	J8/10	led2_e	27	J9/10
led0_f	8	J8/9	led2_f	28	J9/9
led0_g	9	J8/12	led2_g	29	J9/12
led0_dp	10	J8/11	led2_dp	30	J9/11
led1_a	12	J8/14	led3_a	31	J9/14
led1_b	13	J8/13	led3_b	32	J9/13
led1_c	14	J8/16	led3_c	35	J9/16
led1_d	16	J8/15	led3_d	36	J9/15
led1_e	17	J8/18	led3_e	37	J9/18
led1_f	19	J8/17	led3_f	40	J9/17
led1_g	20	J8/20	led3_g	41	J9/20
led1_dp	21	J8/19	led3_dp	42	J9/19

Table 1 Mapping of CPLD pins to Expansion Connectors

2.2.3 Reset Push Button

Your Post-It board contains a momentary push button, which is connected directly to the global reset pin of the CPLD.

The global reset pin is called GCLRn and corresponds to pin 89. This pin is also pulled up to VCC through a 10Kohm pull-up resistor, R9.

2.2.4 Dip Switch

Your Post-It board contains an 8 position DIP switch. A pull-up resistor of 10K connects each of the 8 switches to VCC. Table 2 illustrates the connection to the CPLD and the expansion connector

SWITCH	CPLD pin	Connector/Pin
1	52	J10/6
2	54	J10/5
3	55	J10/8
4	56	J10/7
5	57	J10/10
6	58	J10/9
7	60	J10/12
8	61	J10/11

Table 2 Mapping of DIP Switch to CPLD and expansion connector

2.2.5 RS-232 Connector

Your Post-It board also contains a male DB-9 RS-232 connector. All of the pins of the connector except the ground pin (pin 5), goes to the CPLD as well as to the expansion connector J11. Table 3 summarizes the pin-outs.

Note that, level shifters are *not* built-in to the board. So, this connector can be used to interface to peripherals, such as keyboard, mice, and to other Post-It boards. You need to provide an external level-shifter (such as Telcom's TC232) in order to interface to a PC.

Further, note that most mice/keyboard requires 5.0V, so set J2 to 5.0V.

RS-232 Pin	Typical Function	CPLD pin	Connector/Pin
1	Carrier Detect	85	J11/6
2	Receive Data	84	J11/5
3	Transmit Data	81	J11/8
4	Data Terminal Ready	79	J11/7
5	GND	---	
6	Data Set Ready	76	J11/10
7	Request to Send	77	J11/9
8	Clear to Send	80	J11/12
9	Ring Indicator	83	J11/11

Table 3 Mapping of RS-232 Connector to the CPLD and expansion connector

2.2.6 Digital Thermal Sensor

Your Post-It also contains an on-board digital thermal sensor. For more information on this sensor refer to LM75 data sheet. The thermal sensor uses IIC (inter integrated chip) serial protocol communication. A sample design

project included with the CD uses the LM75 to turn your Post-It into an accurate Digital Thermometer.

Table 4 summarizes the connection between the CPLD and the Thermal Sensor. Both the serial data and serial clock pins are pulled-up to VCC through a 10Kohm pull-up resistor, as required by the IIC protocol.

LM75 Pin	Typical Function	CPLD pin	Connector/Pin
1	IIC Data	100	J11/19
2	IIC Clock	99	J11/20

Table 4 Mapping of LM75 pins to the CPLD and expansion connector

2.2.7 Expansion Connectors

Almost all uncommitted I/O pins of the CPLD are brought out to the Expansion Connectors J8 through J11.

Expansion Connector J8			
Connector Pin	Signal / Pin	Connector Pin	Signal / Pin
1	GND	2	GND
3	VCC	4	VCC
5	2	6	1
7	6	8	5
9	8	10	7
11	10	12	9
13	13	14	12
15	16	16	14
17	19	18	17
19	21	20	20
21	--	22	--
23	--	24	--
25	GND	26	GND

Expansion Connector J9			
Connector Pin	Signal / Pin	Connector Pin	Signal / Pin
1	GND	2	GND
3	VCC	4	VCC
5	23	6	22
7	25	8	24
9	28	10	27
11	30	12	29
13	32	14	31
15	36	16	35
17	40	18	37
19	42	20	41
21	--	22	--
23	--	24	--
25	GND	26	GND

Expansion Connector J10			
Connector Pin	Signal / Pin	Connector Pin	Signal / Pin
1	GND	2	GND
3	VCC	4	VCC
5	54	6	52
7	56	8	55
9	58	10	57
11	61	12	60
13	64	14	63
15	68	16	67
17	70	18	69
19	72	20	71
21	--	22	75
23	--	24	--
25	GND	26	GND

Expansion Connector J11			
Connector Pin	Signal / Pin	Connector Pin	Signal / Pin
1	GND	2	GND
3	VCC	4	VCC
5	84	6	85
7	79	8	81
9	77	10	76
11	83	12	80
13	93	14	92
15	96	16	94
17	98	18	97
19	100	20	99
21	GND	22	GND
23	90	24	87
25	GND	26	GND