

Digilent C-Mod™ Boards Reference Manual

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Overview

C-Mod boards combine a Xilinx CPLD, a JTAG programming port, and power supply circuits in a convenient 600-mil, 40-pin DIP package. C-Mods are ideally suited for breadboard or other prototype circuit designs where the use of small surface mount packages is impractical. All C-Mod boards include:

- A single 3.3V supply voltage (voltage regulation provided on C-Mod board where required);
- Adequate bypass capacitance on all CPLD voltage supply pins;
- All available user I/O signals brought out to DIP pins;
- Once programmed, CPLD designs are non-volatile;
- Designs can easily be ported between C-Mods using different CPLD device families;
- All C-Mod boards are compatible with the free Xilinx WebPack tools.

C-Mods were created to make the latest Xilinx CPLDs more practical for experimental and prototype circuits. They can plug directly in to breadboards or IC sockets, and they can mate with the Digilent Ceres™ board to utilize a collection of ready-made I/O circuits. C-Mods are available with CoolRunner-II CPLDs (C-Mod C2), CoolRunner CPLDs (C-Mod XCR), and XC95 CPLDs (C-Mod 95). C-Mod boards are especially useful for investigating designs across a variety of CPLD families.

Functional Description

C-Mod boards, which measure just 0.7" by 2.16", allow designers to experiment with CPLD-based designs in a variety of state-of-

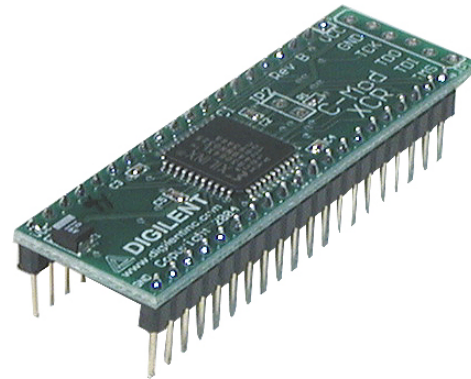


Figure 1. C-Mod XCR module

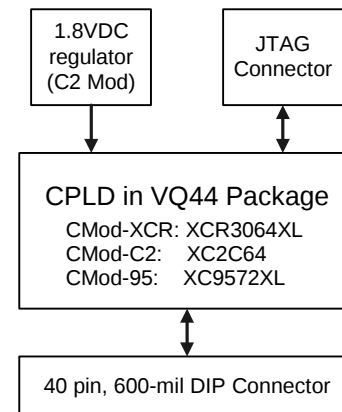


Figure 2. C-Mod circuit board block diagram

the art devices. Designs can easily be ported from one C-Mod to another, so that design performance in different devices can be compared and contrasted. The 40-pin DIP form factor allows C-Mods to be used in breadboard or other through-hole circuits where surface-mount devices are impractical. They can be configured with a wide range logic circuits, from simple logic functions to sequential controllers. All available CPLD I/O signals are routed to the 40-pin DIP connections.

When used in conjunction with the Ceres board, C-Mods can be used to rapidly implement CPLD based circuits, or to gain exposure to Xilinx CAD tools and CPLD-oriented design methods. The Ceres board provides C-Mods with a power supply, a clock source, input buttons and switches, and various output LEDs. The Ceres/C-mod combination makes an excellent platform for use in teaching labs.

C-Mods are programmed with a sample design during manufacturing. This design, available at the Digilent website, can be used to verify C-Mod/Ceres function. It also provides a simple reference design example of a Xilinx project.

CPLD Configuration

C-Mod boards contain a JTAG port for CPLD programming. The port consists of a pattern of six offset holes that are not loaded with header pins. To use this port, a row of six unattached header pins can be inserted into the end of a JTAG3 (or other) cable, and the other side of the header can be inserted into the offset hole patterns. Once the C-Mod board is connected to the PC via the JTAG cable, the configuration software will automatically detect the CPLD.

JTAG Signal	XC2C64 pin	XC9572XL pin	XCR3064 pin
TCK	11	11	26
TDI	9	9	1
TDO	24	24	32
TMS	10	10	7

Table 1. CPLD JTAG Pins

To configure the board from a computer using the JTAG port, first ensure the C-Mod is powered with a 3.3V supply (such as provided by the Ceres board), and that the JTAG cable is properly connected to the C-Mod and to the computer. Start the configuration program (e.g., the iMPACT programmer available in the Xilinx WebPack tools), and the board will be auto-detected. Device programming and other

JTAG operations are available in a pull-down menu made visible by right clicking on the device graphic in the programmer window.

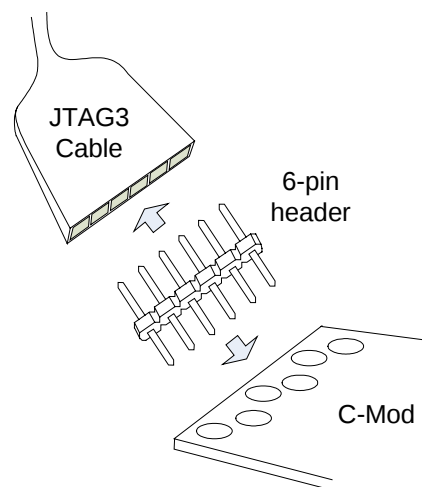


Figure 3. JTAG cable used with C-Mod

Power Supplies

C-Mod boards require a single 3.3V supply on pin 20, and a single GND on pin 21. Current consumption is dependant on CPLD family, CPLD configuration, and external circuits. In most cases, current will be far less than 100mA, but the Xilinx data sheets for the particular CPLD should be referenced for more information.

CPLDs

C-Mod boards are available with CoolRunner-2, CoolRunner (XPLA), and XC95 CPLDs. All available CPLD I/O signals are routed to the DIP connector, and the JTAG signals are routed to a programming connector. CPLD pinouts are provided in tables 2 and 3 below. Please see the data sheets for the CPLDs available at the Xilinx web site for more information.

DIP PIN	Ceres Signal	C-Mod C2			C-Mod 95			C-Mod XCR		
		XC2C64 pin	type	Function Block	XC9572XL pin	type	Function Block	XCR3064 pin	type	Function Block
1	CA	12	IO	4	12	IO	3	12	IO	4
2	CB	13	IO	4	13	IO	3	13	IO	4
3	CC	14	IO	4	14	IO	3	14	IO	4
4	CD	16	IO	4	16	IO	3	15	IO	4
5					7	IO	3			
6										
7										
8										
9	CE	18	IO	3	18	IO	3	18	IO	3
10	CF	19	IO	3	19	IO	4	19	IO	3
11	CG	20	IO	3	20	IO	4	20	IO	3
12	AN3	21	IO	3	21	IO	4	21	IO	3
13	AN2	22	IO	3	22	IO	4	22	IO	3
14	AN1	23	IO	3	23	IO	4	23	IO	3
15	AN0	27	IO	3	27	IO	4	25	IO	3
16	SW7	28	IO	3	28	IO	4	27	IO	1
17	DP	29	IO	3	29	IO	2			
18	BTN3	30	GSR	1	30	IO	2	6	IO	2
19										
20		15	VCC		26	VCCIO		9,17,29, 41	VCC	
20		7,26	VCCIO		15,35	VCCINT				
20		35	VAUX							
21		4,17,25	GND		4,17,25	GND		16,24,36	GND	
22	SW6	31	GTS2	1	31	IO	2	28	IO	1
23	SW5	32	GTS3	1	32	IO	2	30	IO	1
24	SW4	33	GTS0	1	33	GSR	1	31	IO	1
25	SW3	34	GTS1	1	34	GTS2	2	33	IO	1
26	SW2	36	IO	1	36	GTS1	2	34	IO	1
27	SW1	37	IO	1	37	IO	2	35	IO	1
									IN3/CLK	
28	BTN2	38	IO	1	38	IO	2	37	3	
29	SW0	39	IO	2	39	IO	1	42	IO	2
30	LED7	40	IO	2	40	IO	1	43	IO	2
31	LED6	41	IO	2	41	IO	1	44	IO	2
32	LED5	42	IO	2	42	IO	1	2	IO	2
									IN0/CLK	
33	BTN0	43	GCK0	2	43	GCK1	1	40	0	
									IN1/CLK	
34	BTN1	44	GCK1	2	44	GCK2	1	39	1	
									IN2/CLK	
35	MCLK	1	GCK2	2	1	GCK3	1	38	2	
36	LED4	2	IO	2	2	IO	1	3	IO	2
37	LED3	3	IO	2	3	IO	1	5	IO	2
38	LED2	5	IO	4	5	IO	3	8	IO	4
39	LED1	6	IO	4	6	IO	3	10	IO	4
40	LED0	8	IO	4	8	IO	3	11	IO	4