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CPLD Development/Programmer Kit

User Guide

Table of Contents

CPLD Development/Programmer Kit User Guide

Section 1

Introduction

1.1 CPLD Development/ Programmer Kit

The Atmel CPLD Development/Programmer Kit (P/N: ATF15xx-DK2) is a complete development system and an In-System Programming (ISP) programmer for the ATF15xx family of industry-standard pin-compatible Complex Programmable Logic Devices (CPLDs) with Logic Doubling™ features. This kit provides designers a very quick and easy way to develop, prototype and evaluate new designs with an ATF15xx CPLD. With the availability of the different Socket Adapter Boards to support all the package types offered in the ATF15xx family of ISP CPLDs, this CPLD Development/Programmer Board can be used as an ISP programmer to program the ATF15xx ISP CPLDs in all the available package types through the industry-standard JTAG interface (IEEE 1149.1a-1993).

Figure 1-1. Contents of the ATF15xx-DK2

| 1.2 | **Kit Contents** | ■ CPLD Development/Programmer Board |

- 84-lead PLCC Socket Adapter Board (P/N: ATF15xx-SAJ84)[1]
- Atmel CPLD ISP Download Cable
- Atmel PLD Software CD-ROM (includes ProChip Designer™, Atmel-WinCUPL™ and other EPLD software)
- Atmel CD-ROM Data Books
- One ATF1508AS 5V 84-lead PLCC Sample Device
- One ATF1508ASVL 3.3V, low-power, 84-lead PLCC Sample Device
- Atmel CPLD Development/Programmer Kit User Guide

Note: 1. Only the 84-lead PLCC Socket Adapter Board is included in this kit. Other Socket Adapter Boards are sold separately. Please refer to Section 1.6 for ordering information of the Socket Adapter Boards.

1.3 Kit Features

| 1.3.1 | **CPLD Development/ Programmer Board** | ■ 10-lead JTAG-ISP Port |

- Regulated Power Supply Circuitry for 9V DC Power Source
- 5V or 3.3V V_{CC} Operation
- 84-lead PLCC Socket Adapter Board
- Socket Adapter Board Headers
- Expansion Terminal Holes for all Input and I/O pins of the ATF15xx Device
- 2 MHz Crystal Oscillator
- Eight 8-segment LED Displays
- Global Clear and Output Enable Push Button Switches

| 1.3.2 | **Logic Doubling CPLDs** | ■ ATF1508AS-15JC84, 5V 128-Macrocell ISP CPLD with Logic Doubling Architecture |

- ATF1508ASVL-20JC84, 3.3V Low-power 128-Macrocell ISP CPLD with Logic Doubling Architecture

| 1.3.3 | **CPLD ISP Download Cable** | ■ 5V/3.3V ISP Download Cable for PC Parallel Printer (LPT) Port |

| 1.3.4 | **PLD Software CD-ROM** | ■ Free Atmel-WinCUPL™ Design Software |

- 30-day Trial Version of Atmel ProChip Designer™ Software
- Full Licensed Version of Atmel ProChip Designer Software (permanent license required)
- Atmel CPLD ISP Software (ATMISP)
- POF2JED Conversion Utility
- Logic Doubling Support and Documentation

1.3.5   **Atmel CD-ROM Data Books**

- Data Sheets
- Application Notes
- Manuals and User Guides

1.4   **Device Support**

The Atmel CPLD Development/Programmer Board supports the following devices in all speed grades and packages:

ATF1502AS/ASL	ATF1508AS/ASL
ATF1502ASV	ATF1508ASV/ASVL
ATF1502SE/SEL	ATF1508SE/SEL
ATF1502AE/AEL	ATF1508AE/AEL
ATF1504AS/ASL	ATF1516SE/SEL (Future)
ATF1504ASV/ASVL	ATF1516AE/AEL (Future)
ATF1504SE/SEL	ATF1532AE/AEL (Future)
ATF1504AE/AEL	

1.5   **System Requirements**

The minimum hardware and software requirements to program an ATF15xx ISP CPLD on the CPLD Development/Programmer Board through the Atmel CPLD ISP Software (ATMISP) V4.0 or later are:

- Pentium® or Pentium-compatible microprocessor based computer
- Windows® 98, Windows NT® 4.0, Windows ME, or Windows 2000
- 16-MByte RAM
- 10-MByte free hard disk space
- Windows-supported mouse
- Available parallel printer (LPT) port
- 9V DC power supply with 500 mA of supply current
- SVGA monitor (800 x 600 resolution)

1.6 Ordering Information

Part Number	Description
ATF15xx-DK2	Atmel CPLD Development/Programmer Kit
ATF15xx-SAA44	44-lead TQFP Socket Adapter Board
ATF15xx-SAJ44	44-lead PLCC Socket Adapter Board
ATF15xx-SAC49	49-lead BGA Socket Adapter Board
ATF15xx-SAJ68	68-lead PLCC Socket Adapter Board
ATF15xx-SAJ84	84-lead PLCC Socket Adapter Board
ATF15xx-SAA100	100-lead TQFP Socket Adapter Board
ATF15xx-SAQ100	100-lead PQFP Socket Adapter Board
ATF15xx-SACT100	100-lead BGA Socket Adapter Board
ATF15xx-SAA144	144-lead TQFP Socket Adapter Board
ATF15xx-SAQ160	160-lead PQFP Socket Adapter Board
ATF15xx-SAC169	169-lead BGA Socket Adapter Board
ATF15xx-SAQ208	208-lead PQFP Socket Adapter Board
ATF15xx-SACT256	256-lead BGA Socket Adapter Board

1.7 Technical Support

For technical support on any Atmel PLD related issues, please contact the Atmel PLD Applications Group at:

Hotline: 1-408-436-4333

Email: pld@atmel.com

URL: www.atmel.com/atmel

1.8 References

To help PLD designers use the different Atmel PLD software, documentation such as Help Files, Tutorials, Application Notes/Briefs, and User Guides are available.

1.8.1 ProChip Designer

ProChip Designer Help Files	From the ProChip Designer main window, click on HELP and then select PROCHIP DESIGNER HELP.
Tutorials	From the ProChip Designer main window, click on HELP and then select TUTORIALS.
Known Problems & Solutions	From the ProChip Designer main window, click on HELP and then select REVIEW KPS.

1.8.2 Atmel-WinCUPL

Help Files	From the Atmel-WinCUPL main window, click on HELP and then select CONTENTS.
CUPL Programmers Reference Guide	From the Atmel-WinCUPL main window, click on HELP and then select CUPL PROGRAMMERS REFERENCE.
Tutorial	From the Atmel-WinCUPL main window, click on HELP, select ATMEL INFO and then select TUTORIAL1.PDF.
Known Problems & Solutions	From the Atmel-WinCUPL main window, click on HELP, select ATMEL INFO and then select CUPL_BUG.PDF.

1.8.3 ATMISP

Help Files	From the ATMISP main window, click on HELP and then select ISP HELP.
Tutorial	From the ATMISP main window, click on HELP, and then select ATMISP TUTORIAL.
Known Problems & Solutions	Using Windows Explorer, go to the directory where ATMISP is installed and open the README.TXT file through any ASCII text editor.

1.8.4 POF2JED

ATF15xx Conversion Application Brief	From the POF2JED main window, click on HELP and then select CONVERSION OPTIONS.

CPLD Development/Programmer Kit User Guide

Section 2

Hardware Description

2.1 Atmel CPLD Development/ Programmer Board

The Atmel CPLD Development/Programmer Board, along with the Socket Adapter Board as shown in Figure 2-1, contains many features that designers will find very useful when developing, prototyping, or evaluating their ATF15xx CPLD design. Features such as push-button switches, 8-segment display LEDs, 2 MHz crystal oscillator, 5V/3.3V V_{CC} selector, JTAG-ISP port, and expansion terminal holes make this a very versatile starter/development kit and an ISP programmer for the ATF15xx family of JTAG-ISP CPLDs.

Figure 2-1. CPLD Development/Programmer Board with 84-lead PLCC Socket Adapter Board
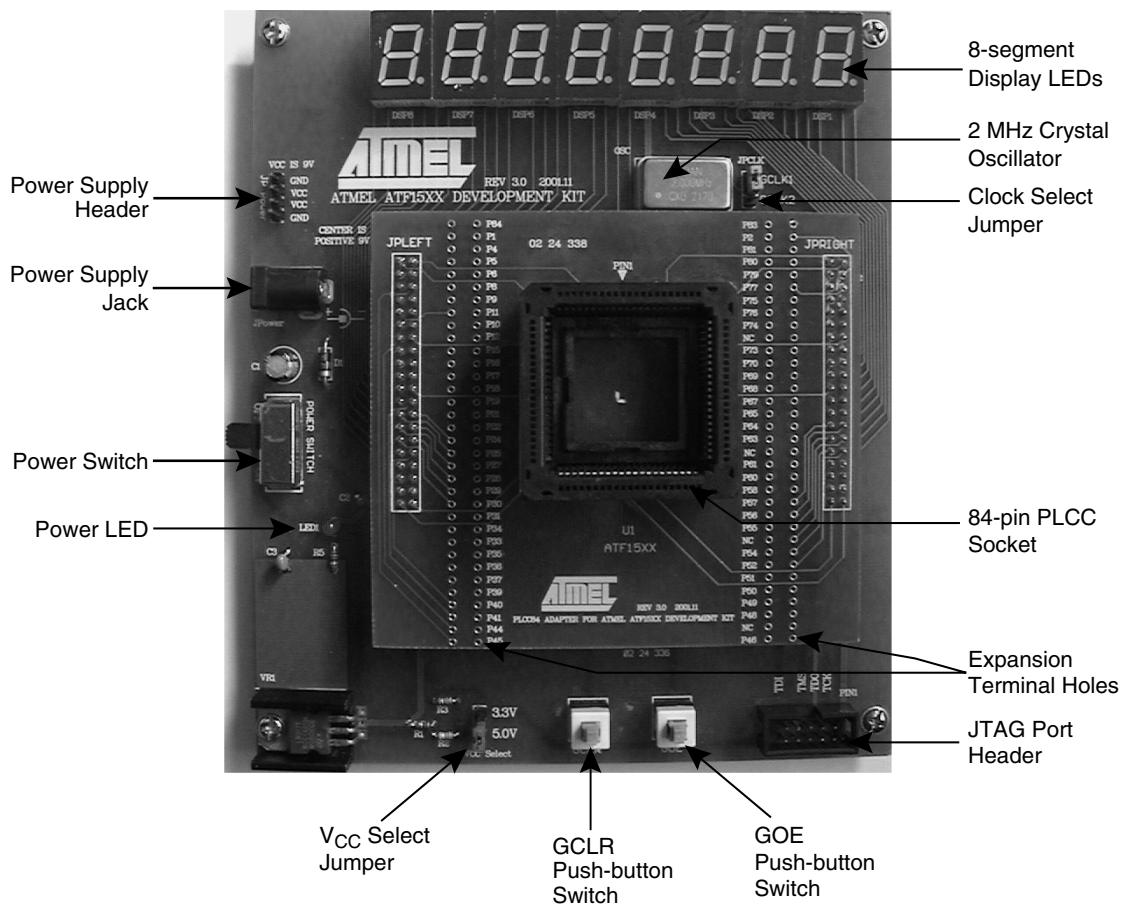
2.1.1   **8-segment Display LEDs**

The Atmel CPLD Development/Programmer Board contains eight 8-segment LEDs to allow the designer to observe the outputs of the ATF15xx. These eight LEDs are labeled **DSP1** to **DSP8** on the board. These eight display LEDs are common anode LEDs with the common anode lines connected to V_{CC} and the individual cathode lines connected to the I/O pins of the ATF15xx CPLD on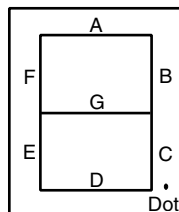 the CPLD Development/Programmer Board. To turn on a particular segment of an LED, the corresponding ATF15xx I/O pin connected to this LED segment must be in a logical-0 state. Hence, the outputs of the ATF15xx need to be configured as active-low outputs in the design file.

Figure 2-2. 8-segment Display LED

Each segment of the display LED is hard-wired to one specific I/O pin of the ATF15xx. For the higher pin count devices (100-lead and larger), all eight segments of the eight LEDs are connected to the I/O pins of the ATF15xx. However, for the lower pin count devices (84-lead and smaller), only a subset of the LED segments are connected to the ATF15xx's I/O pins. Table 2-1 to Table 2-8 below show the connections of the LEDs to the ATF15xx in all the different package types.

Table 2-1. Connections of LEDs to ATF15xx 44-lead PLCC

DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #
1/A	NC	3/A	28	5/A	6	7/A	NC
1/B	NC	3/B	26	5/B	4	7/B	NC
1/C	NC	3/C	24	5/C	5	7/C	NC
1/D	NC	3/D	25	5/D	8	7/D	NC
1/E	NC	3/E	27	5/E	11	7/E	NC
1/F	NC	3/F	29	5/F	9	7/F	NC
1/G	NC	3/G	31	5/G	12	7/G	NC
1/DOT	NC	3/DOT	NC	5/DOT	NC	7/DOT	NC
2/A	NC	4/A	36	6/A	18	8/A	NC
2/B	NC	4/B	33	6/B	16	8/B	NC
2/C	NC	4/C	34	6/C	14	8/C	NC
2/D	NC	4/D	40	6/D	17	8/D	NC
2/E	NC	4/E	37	6/E	19	8/E	NC
2/F	NC	4/F	39	6/F	20	8/F	NC
2/G	NC	4/G	41	6/G	21	8/G	NC
2/DOT	NC	4/DOT	NC	6/DOT	NC	8/DOT	NC

Table 2-2. Connections of LEDs to ATF15xx 44-lead TQFP

DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #
1/A	NC	3/A	21	5/A	44	7/A	NC
1/B	NC	3/B	19	5/B	42	7/B	NC
1/C	NC	3/C	18	5/C	43	7/C	NC
1/D	NC	3/D	20	5/D	2	7/D	NC
1/E	NC	3/E	22	5/E	5	7/E	NC
1/F	NC	3/F	23	5/F	3	7/F	NC
1/G	NC	3/G	25	5/G	6	7/G	NC
1/DOT	NC	3/DOT	NC	5/DOT	NC	7/DOT	NC
2/A	NC	4/A	30	6/A	12	8/A	NC
2/B	NC	4/B	27	6/B	10	8/B	NC
2/C	NC	4/C	28	6/C	8	8/C	NC
2/D	NC	4/D	34	6/D	11	8/D	NC
2/E	NC	4/E	31	6/E	13	8/E	NC
2/F	NC	4/F	33	6/F	14	8/F	NC
2/G	NC	4/G	35	6/G	15	8/G	NC
2/DOT	NC	4/DOT	NC	6/DOT	NC	8/DOT	NC

Table 2-3. Connections of LEDs to ATF15xx 68-lead PLCC

DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #
1/A	NC	3/A	47	5/A	5	7/A	25
1/B	NC	3/B	45	5/B	4	7/B	24
1/C	NC	3/C	44	5/C	7	7/C	27
1/D	NC	3/D	46	5/D	9	7/D	29
1/E	NC	3/E	49	5/E	13	7/E	32
1/F	NC	3/F	51	5/F	8	7/F	28
1/G	NC	3/G	52	5/G	10	7/G	30
1/DOT	NC	3/DOT	NC	5/DOT	NC	7/DOT	NC
2/A	37	4/A	56	6/A	17	8/A	NC
2/B	33	4/B	54	6/B	14	8/B	NC
2/C	36	4/C	55	6/C	15	8/C	NC
2/D	39	4/D	61	6/D	18	8/D	NC
2/E	41	4/E	59	6/E	22	8/E	NC
2/F	40	4/F	60	6/F	20	8/F	NC
2/G	42	4/G	64	6/G	23	8/G	NC
2/DOT	NC	4/DOT	NC	6/DOT	NC	8/DOT	NC

Table 2-4. Connections of LEDs to ATF15xx 84-lead PLCC

DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #
1/A	49	3/A	67	5/A	6	7/A	25
1/B	46	3/B	64	5/B	4	7/B	22
1/C	48	3/C	65	5/C	5	7/C	24
1/D	50	3/D	68	5/D	8	7/D	27
1/E	52	3/E	70	5/E	10	7/E	29
1/F	51	3/F	69	5/F	9	7/F	28
1/G	54	3/G	73	5/G	11	7/G	30
1/DOT	NC	3/DOT	NC	5/DOT	45	7/DOT	41
2/A	57	4/A	76	6/A	16	8/A	34
2/B	55	4/B	74	6/B	12	8/B	31
2/C	56	4/C	75	6/C	15	8/C	33
2/D	58	4/D	77	6/D	17	8/D	35
2/E	61	4/E	80	6/E	20	8/E	37
2/F	60	4/F	79	6/F	18	8/F	36
2/G	63	4/G	81	6/G	21	8/G	39
2/DOT	NC	4/DOT	NC	6/DOT	44	8/DOT	40

Table 2-5. Connections of LEDs to ATF15xx 100-lead TQFP

DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #
1/A	47	3/A	67	5/A	96	7/A	20
1/B	52	3/B	64	5/B	93	7/B	17
1/C	48	3/C	63	5/C	94	7/C	19
1/D	46	3/D	65	5/D	97	7/D	21
1/E	44	3/E	68	5/E	99	7/E	25
1/F	45	3/F	69	5/F	98	7/F	23
1/G	42	3/G	71	5/G	100	7/G	29
1/DOT	49	3/DOT	61	5/DOT	92	7/DOT	22
2/A	54	4/A	80	6/A	12	8/A	32
2/B	41	4/B	76	6/B	9	8/B	30
2/C	40	4/C	78	6/C	8	8/C	31
2/D	56	4/D	84	6/D	10	8/D	33
2/E	58	4/E	81	6/E	13	8/E	36
2/F	57	4/F	83	6/F	14	8/F	35
2/G	60	4/G	85	6/G	16	8/G	37
2/DOT	55	4/DOT	75	6/DOT	6	8/DOT	28

CPLD Development/Programmer Kit User Guide

Table 2-6. Connections of LEDs to ATF15xx 100-lead PQFP

DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #
1/A	48	3/A	69	5/A	98	7/A	22
1/B	50	3/B	66	5/B	95	7/B	19
1/C	49	3/C	65	5/C	96	7/C	21
1/D	47	3/D	67	5/D	99	7/D	23
1/E	44	3/E	70	5/E	3	7/E	27
1/F	46	3/F	71	5/F	100	7/F	25
1/G	43	3/G	73	5/G	4	7/G	39
1/DOT	51	3/DOT	63	5/DOT	94	7/DOT	24
2/A	56	4/A	82	6/A	14	8/A	37
2/B	54	4/B	78	6/B	11	8/B	38
2/C	42	4/C	81	6/C	10	8/C	35
2/D	58	4/D	86	6/D	12	8/D	33
2/E	60	4/E	83	6/E	15	8/E	31
2/F	59	4/F	85	6/F	16	8/F	34
2/G	62	4/G	87	6/G	18	8/G	32
2/DOT	52	4/DOT	77	6/DOT	8	8/DOT	30

Table 2-7. Connections of LEDs to ATF15xx 144-lead TQFP

DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #
1/A	79	3/A	100	5/A	134	7/A	25
1/B	78	3/B	98	5/B	137	7/B	22
1/C	74	3/C	99	5/C	136	7/C	23
1/D	80	3/D	101	5/D	133	7/D	26
1/E	82	3/E	106	5/E	138	7/E	28
1/F	81	3/F	102	5/F	132	7/F	27
1/G	83	3/G	107	5/G	131	7/G	29
1/DOT	77	3/DOT	97	5/DOT	139	7/DOT	21
2/A	88	4/A	118	6/A	9	8/A	41
2/B	86	4/B	119	6/B	7	8/B	31
2/C	87	4/C	117	6/C	6	8/C	32
2/D	91	4/D	114	6/D	8	8/D	38
2/E	93	4/E	112	6/E	10	8/E	37
2/F	92	4/F	116	6/F	11	8/F	40
2/G	94	4/G	113	6/G	15	8/G	39
2/DOT	84	4/DOT	111	6/DOT	5	8/DOT	30

Table 2-8. Connections of LEDs to ATF15xx 160-lead PQFP

DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #	DSP/Sgt	PLD Pin #
1/A	91	3/A	102	5/A	11	7/A	29
1/B	89	3/B	100	5/B	159	7/B	27
1/C	90	3/C	98	5/C	160	7/C	28
1/D	80	3/D	101	5/D	10	7/D	52
1/E	73	3/E	103	5/E	12	7/E	50
1/F	78	3/F	105	5/F	13	7/F	53
1/G	72	3/G	106	5/G	14	7/G	51
1/DOT	88	3/DOT	97	5/DOT	158	7/DOT	25
2/A	69	4/A	110	6/A	20	8/A	43
2/B	71	4/B	108	6/B	18	8/B	49
2/C	68	4/C	109	6/C	16	8/C	30
2/D	92	4/D	123	6/D	19	8/D	31
2/E	94	4/E	111	6/E	21	8/E	32
2/F	93	4/F	121	6/F	23	8/F	41
2/G	96	4/G	122	6/G	24	8/G	33
2/DOT	70	4/DOT	107	6/DOT	15	8/DOT	48

2.1.2   Push-button Switches

Two push-button switches are provided to allow the user to control the logic states of the OE1 and GCLR inputs of the ATF15xx. These two switches are labeled GOE and GCLR on the board. The GCLR push-button switch is a momentary Single-Pole Single-Throw (SPST) normally open switch while the GOE push-button switch is a snap-acting momentary SPST normally open switch. As shown in the CPLD Development/Programmer Board schematic in Figure 4-1, these two switches are normally open and the GCLR and GOE signals are pulled-up to V_{CC} when they are not depressed. When the switches are depressed, the GCLR and GOE signals are connected to GND.

The output of the GCLR switch is connected to the GCLR dedicated input pin of the ATF15xx, and it is intended to be used as an active-low reset signal to reset the registers in the ATF15xx. The output of the GOE switch is connected to the OE1 dedicated input pin of the ATF15xx. It is intended to be used as an active-high or active-low output enable signal to control the enabling/disabling of the tri-state output buffers in the ATF15xx. However, these two switches can also be used to generate general logic input signals to the GCLR and OE1 input pins of the ATF15xx.

2.1.3   Clock Select Jumper

The Clock Select Jumper, labeled JPCLK, on the CPLD Development/Programmer Board is a two-position jumper that allows the user to select which GCLK dedicated input pin (either GCLK1 or GCLK2) of the ATF15xx should be connected to the output of the 2 MHz crystal oscillator. In addition, the jumper can be removed to allow an external clock source to be connected to GCLK1 and/or GCLK2 of the ATF15xx.

Table 2-9 shows the pin numbers for the GCLR, OE1, GCLK1 and GCLK2 dedicated input pins of the ATF15xx in all the available package types.

Table 2-9. Pin Numbers of GCLR, OE1, GCLK1 and GCLK2

Signal	44-lead TQFP	44-lead PLCC	68-lead PLCC	84-lead PLCC	100-lead PQFP	100-lead TQFP	144-lead TQFP	160-lead PQFP
GCLR	39	1	1	1	91	89	127	141
OE1	38	44	68	84	90	88	126	140
GCLK1	37	43	67	83	89	87	125	139
GCLK2	40	2	2	2	92	90	128	142

2.1.4   V$_{CC}$ Select Jumper   The V$_{CC}$ Select Jumper, labeled VCC Select, on the CPLD Development/Programmer Board is a two-position jumper that allows the users to select the V$_{CC}$ voltage level (either 3.3V or 5.0V) used by various components on the CPLD Development/Programmer Board. This voltage generated by the on-board voltage regulation circuitry is applied to the V$_{CC}$ input pins (both VccINT and VccIO) of the ATF15xx, the common anode lines of the eight 8-segment LEDs, the V$_{CC}$ input of the 2 MHz crystal oscillator, the two push-button switches, and the V$_{CC}$ pin (Pin 4) of the 10-pin JTAG port header labeled JTAG.

Therefore, when a 3.3V device (ATF15xxASV/ASVL/AE/AEL) is used on this board, the V$_{CC}$ Select Jumper must be in the 3.3V position. On the other hand, when a 5V device (ATF15xxAS/ASL/SE/SEL) is used on this board, the V$_{CC}$ Select Jumper must be in the 5.0V position. This is also true when the ATF15xx is being programmed through ISP on this board.

2.1.5   JTAG Port Header   The JTAG Port Header, labeled JTAG, on the CPLD Development/Programmer Board is used to connect the ATF15xx's JTAG port pins (TCK, TDI, TMS and TDO) through the ISP download cable to the parallel printer (LPT) port of a PC for ISP programming of the ATF15xx. Table 2-10 shows the pin numbers for the four JTAG port pins of the ATF15xx in all the available package types.

Table 2-10. Pin Numbers of JTAG Port Signals

Signal	44-lead TQFP	44-lead PLCC	68-lead PLCC	84-lead PLCC	100-lead PQFP	100-lead TQFP	144-lead TQFP	160-lead PQFP
TDI	1	7	12	14	6	4	4	9
TDO	32	38	57	71	75	73	104	112
TMS	7	13	19	23	17	15	20	22
TCK	26	32	50	62	64	62	89	99

The ISP algorithm is controlled by the ATMISP software, which runs on the PC. The four JTAG signals are generated by the LPT port and they are buffered by the ISP download cable before going into the ATF15xx on the CPLD Development/Programmer Board. The pinout for the 10-pin JTAG Port Header on the CPLD Development/Programmer Board is shown in Figure 2-3 and the dimensions of this 10-pin male JTAG header are shown in Figure 2-4.

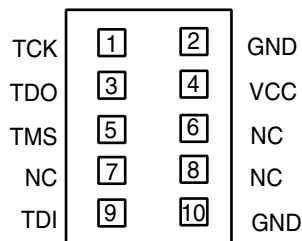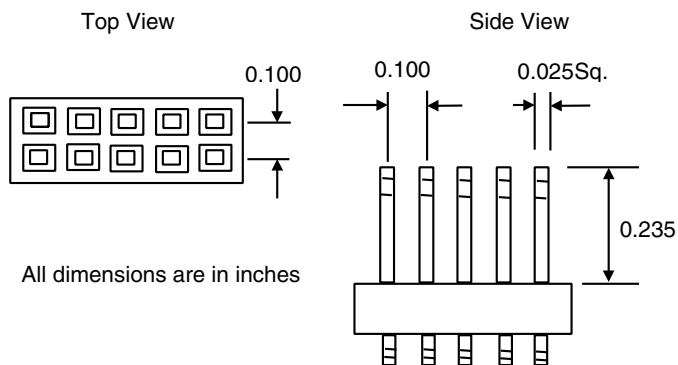*Figure 2-3.* Pinout Diagram of 10-pin JTAG Port Header (Top-view)

Figure 2-4. 10-pin Male Header Dimensions

The pinout of this 10-pin JTAG Port Header is compatible with the Altera® ByteBlaster™ and ByteBlasterMV™ cables. In addition, the ATMISP software allows users to choose either the Atmel CPLD ISP Cable or the ByteBlaster/ByteBlasterMV cable to implement ISP.

2.1.6   Power Connectors   The Atmel CPLD Development/Programmer Board contains two different types of power connectors, and either one can be used to connect to a 9V DC power source to power the board. The first power connector, labeled JPower, is a barrel power jack with a 2.1 mm diameter post and it mates to a 2.1 mm (inner diameter) x 5.5 mm (outer diameter) female plug. The second power connector, labeled JP Power, is a 4-pin male 0.1" header with 0.025" square posts. The availability of these two types of power connectors allows the users to choose the type of power supply equipment to use for the CPLD Development/Programmer Board.

2.2 Socket Adapter Board

Atmel CPLD Development/Programmer Socket Adapter Boards are circuit boards that interface with the Atmel CPLD Development/Programmer Board. They are used in conjunction with the CPLD Development/Programmer Board to evaluate/program Atmel ISP CPLDs in different package types. Currently, there are nine Socket Adapter Boards available covering all the package types offered in the ATF15xx family of CPLDs. They include 44-lead PLCC, 44-lead TQFP, 68-lead PLCC, 84-lead PLCC, 100-lead TQFP, 100-lead PQFP, 144-lead TQFP and 160-lead PQFP. New Socket Adapter Boards will become available when new packages are offered.

Each socket adapter board contains a socket for the Atmel ATF15xx device on the top side and male headers on the bottom side. The headers on the bottom side mate with the female headers, labeled **JPLEFT** and **JPRIGHT**, on the CPLD Development/Programmer Board. The eight 8-segment LEDs, push-button switches, JTAG port signals, crystal oscillator, V_{CC}, and GND on the CPLD Development/Programmer Board are connected to the ATF15xx device on the Socket Adapter Board through these two rows of connectors.

2.2.1 Expansion Terminal Holes

Rows of expansion terminal holes suitable for 0.1" headers with 0.025" square posts are available on each of the Socket Adapter Boards to allow users to interface the ATF15xx to an external circuit board. All input and I/O pins except the four JTAG port pins of the ATF15xx are routed to these expansion terminal holes, and the corresponding pin numbers are marked next to the terminal holes. Please refer to the Socket Adapter Board schematics in Section 4 for the pinouts of the expansion terminal holes.

On the bottom side of the Socket Adapter Boards, traces connecting the pairs of expansion terminal holes can be cut to isolate the LEDs, push-button switches and crystal oscillator from the ATF15xx on the Socket Adapter Board. This allows the users to gain complete control and access to all input and I/O pins of the ATF15xx.

2.3 Atmel CPLD ISP Cable

The Atmel CPLD ISP Cable connects the parallel printer (LPT) port of the user's PC to the 10-pin JTAG header on the Atmel CPLD Development/Programmer Board or a custom circuit board. This is shown in Figure 2-5. This ISP cable acts as a buffer to buffer the JTAG signals between the PC's LPT port and the ATF15xx on the circuit board. The circuit schematic of the Atmel CPLD ISP Cable is shown in Figure 4-10 and Figure 4-11. The Power-On LED on the back of the 25-pin male connector housing indicates that the cable is connected properly. Make sure this LED is turned on before using the Atmel CPLD ISP Software (ATMISP).

This ISP cable consists of a 25-pin (DB25) male connector, which is connected to the LPT port of a PC. The 10-pin female plug connects to the 10-pin male JTAG header on the ISP circuit board. The red color stripe on the ribbon cable indicates the orientation of Pin 1 of the female plug. The 10-pin male JTAG header on the CPLD Development/Programmer Board is polarized to prevent users from inserting the female plug in the wrong orientation.

If the user is attempting to program low voltage (3.3V) devices, the user needs to use Rev. 4 or later of the Atmel CPLD ISP Cable. This and later revisions will support both the 3.3V and 5V ATF15xx ISP CPLDs. Earlier revisions of the cable only supported 5V devices.

When programming 3.3V devices, the V_{CC} supplied to the ISP cable should also be 3.3V. Similarly, the V_{CC} supplied to the ISP cable should be 5.0V when programming 5V devices.

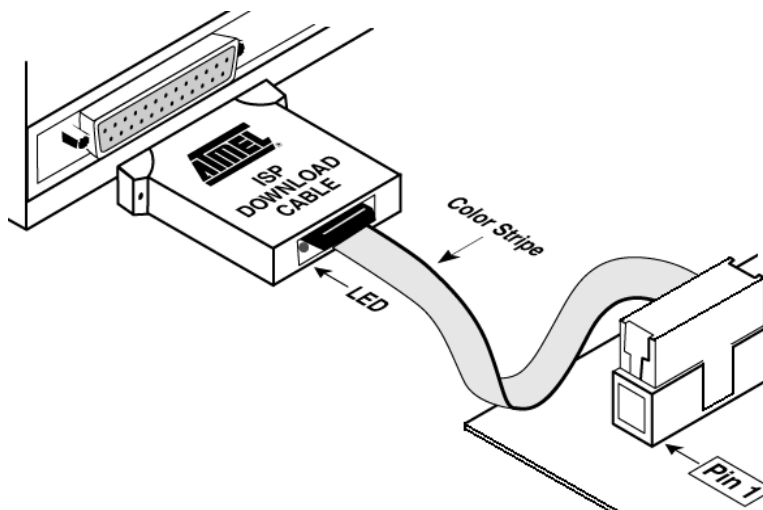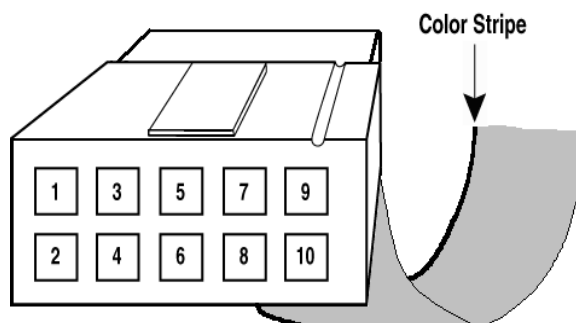**Figure 2-5.** Atmel ISP Cable Connection to ISP Hardware Board/Circuit Board

Figure 2-6 shows the pinout for the 10-pin Female header on the Atmel-ISP Cable. The pinout on the 10-pin male header on the PC board (if used for ISP) must match this pinout.

Figure 2-6. Atmel ISP Download Cable 10-pin Female Header Pinout

Note: The user's circuit board must supply VCC and GND to the Atmel CPLD ISP Cable through the 10-pin male header (See Figure 2-3).

![ATMEL logo]

Section 3

CPLD Design Flow Tutorial

3.1   **Overview**   This tutorial will guide the user through a complete design cycle for the Atmel ATF15xx CPLD with Logic Doubling architecture. It will go through each phase of the design cycle step-by-step from design entry, logic synthesis, device fitting, in-system programming, and finally verifying the design on the Atmel CPLD Development/Programming Board.

Note: To complete this tutorial, ProChip Designer V4.0 or later and Atmel-ISP Software (ATMISP) V4.0 or later are required.

3.2   **Create a Project Using the "New Project Wizard"**   Before starting the design process, a Project File must be created within ProChip Designer. ProChip Designer's **New Project Wizard** provides a very easy way to create a new Project File.

1.   Click on the **START** .... **PROGRAMS** .... **PROCHIP** Icon to launch ProChip Designer. Or double-click on the **PROCHIP** icon on the desktop.

(1) Click to launch ProChip Designer
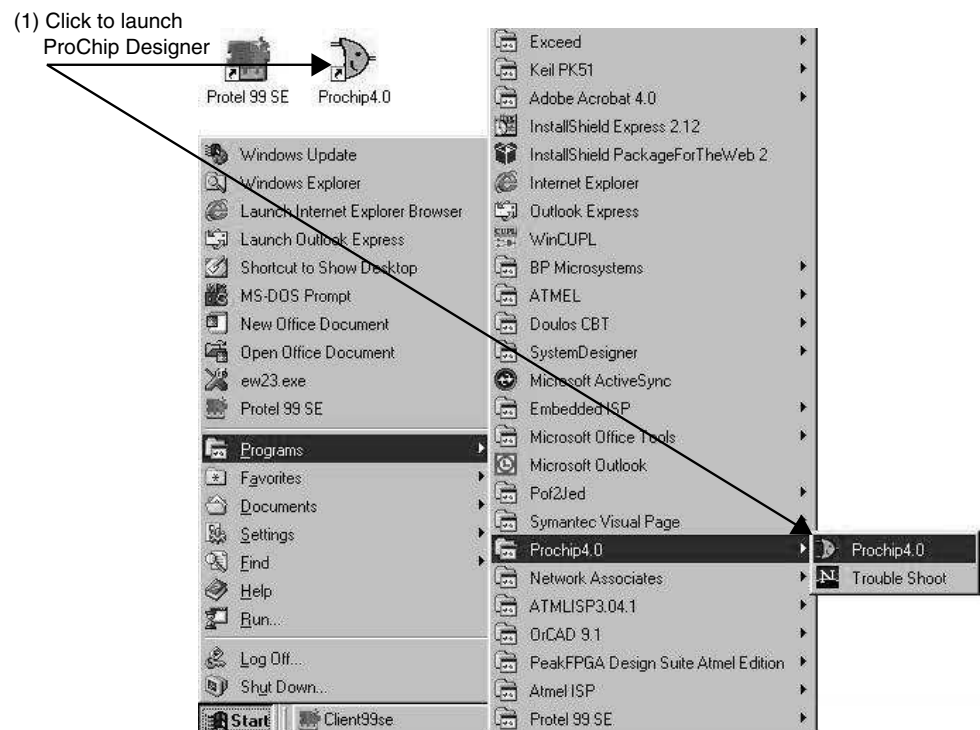
2. Click on **PROJECT** .... **NEW** or double-click on the **NEW PROJECT** shortcut button to launch the New Project Wizard.

(2) Click to create New Project
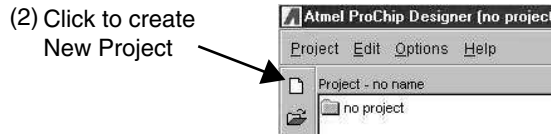
3. Click on the **NEXT** button to start the project file creation process.


(3) Click Next to Start

4. Click on the **BROWSE** button to open the browser window.
5. Use **C:\PROCHIP\DESIGNS\CUPL** as the directory of the project.
6. Enter **DEV_KIT.APJ** as the project filename. The extension of a project file must be .**APJ**.

Note: The name and directory of the design project is specified in this window. All design, simulation and other project files must be placed in this project directory.

(4) Click on Browse

(5) Select the Project Directory

(6) Enter the Project Filename
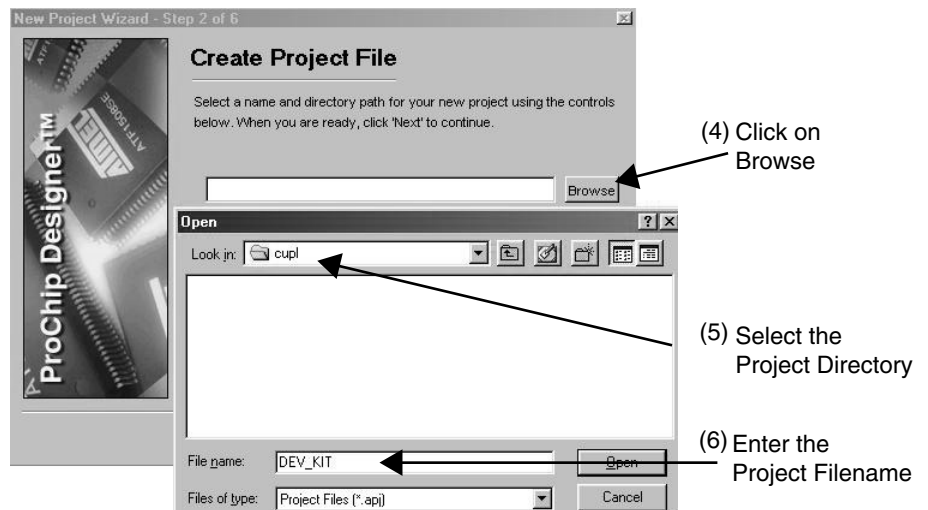
7. Choose **[ATF1508AS-10JC84]** as the target device type for the project. Also review the *Filters* that allow for selection of a specific *Speed Grade* or *Package Type*.

(7) Select the Device Type
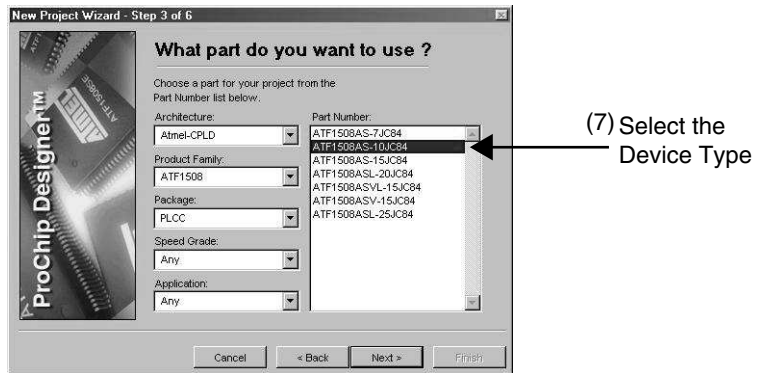
8. Select **CUPL – ALTIUM** as the software tool for this design flow.


(8) Select the Design Flow
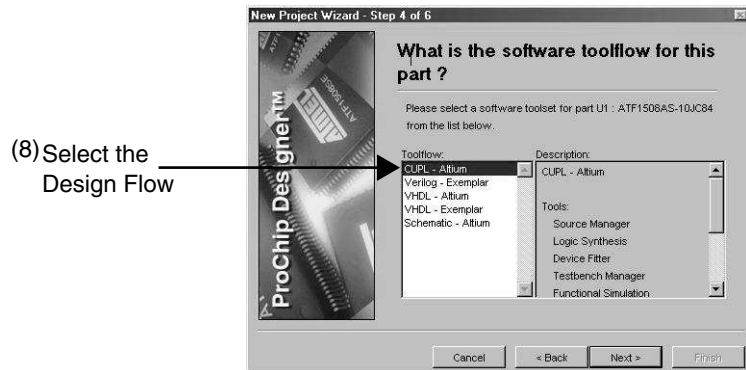
With ProChip Designer V4.0 and later, the five possible design flows and their corresponding design entry types supported are listed in the table below:

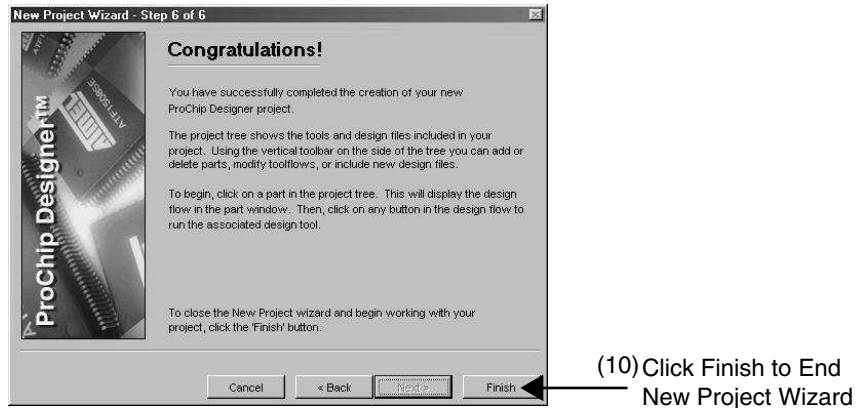| Design Flow	Design Entry Type
CUPL – Altium™	CUPL design entry through Altium Protel™ 99SE
Verilog – Exemplar™(1)	Verilog® design entry through Exemplar Leonardo Spectrum™
VHDL – Altium	VHDL design entry through the Altium PeakFPGA
VHDL – Exemplar(1)	VHDL design entry through Exemplar Leonardo Spectrum
Schematic – Altium	Schematic design entry through Altium Protel 99SE

Note: 1.   Design flow require Mentor Graphics® Leonardo Spectrum software with Atmel CPLD support.

9. Select **DONE WITH PARTS** so that there will be only one device in this project.

On the other hand, users can select **ADD MORE PARTS** to include more parts to the current Project Directory.

(9) Select Done with Parts
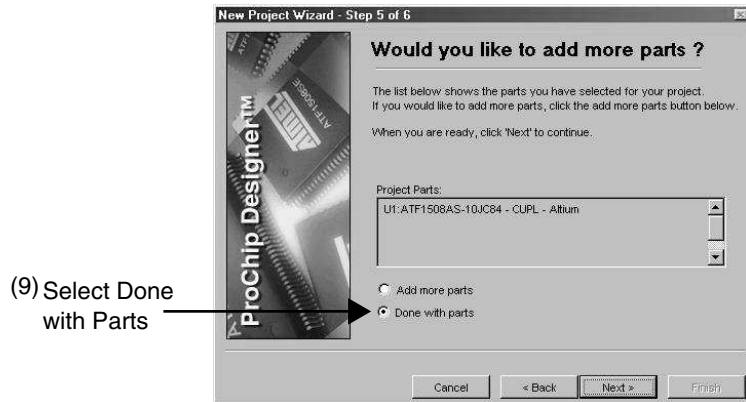
10. Click the **FINISH** button to finish the New Project Wizard and the project creation process.

This closes the *New Project Wizard* and opens the *ProChip Designer* window. The *Sources* in the project are shown in the Left window.

(10) Click Finish to End New Project Wizard

11. Click on the **Device Icon [ATF1508AS-10JC84]** to view the *Design Flow* window.

Project Sources Window   Information Dialog Box

Message Window   (11) Click on the Device Icon

Project File Window   Design Flow Window