

Introduction

The ORCA device family offers many programming options for device configuration. Users can easily incorporate the ORCA Download Cable into their system designs, integrating several modes into one easy-to-use interface for prototype development. The ORCA Download Cable supports all ORCA FPGA and FPSC families. Supported with device programming software that comes with the ORCA Foundry design system, the user can quickly implement system designs. The Cable supports PC compatibility utilizing the serial COM ports. It also supports Unix Workstation ttya and ttyb serial ports. Integrating both serial downloading and JTAG programming into one module, design changes can be downloaded directly to the device. This permits fast and easy prototyping and successive design configuration iterations.

Figure 1. The ORCA Download Cable



Overview

The ORCA Download Cable assembly consists of one DB25 (male or female) connector to the PC or Workstation, a ribbon cable connection from the DB25 connector to the programming module, a programming module and either 7-pin or 8-pin 0.100" connectors for the target board from the programming module. The Cable adapts easily to several V_{CC} supply requirements for the ORCA family. The programming module's power supply comes from the connections on the host PCB and operates with V_{CC} supplies from 2.7V to 5V. The device programming software also supports daisy chaining of ORCA devices using serial or JTAG download options.

Programming of ORCA devices using the serial download option (or slave serial mode) is primarily used when multiple FPGAs are configured in a daisy chain or on the FPGA evaluation board that interfaces to the ORCA Download Cable. A device in the slave serial mode can be used as the lead device in a daisy chain.

Programming can also be done using the JTAG interface. In this option, the FPGAs are connected in series. Each FPGA reads and shifts the preamble and length count in on the positive TCK and out on the negative TCK edges. The loading of configuration data continues after the lead device has received its configuration read into TDI of downstream devices on the positive edge of TCK, and shifted out TDO on the negative edge of TCK.

Figures 2 and 3 show the connections for the JTAG and slave serial configuration mode.

Figure 2. Daisy Chain Programming Example Using JTAG

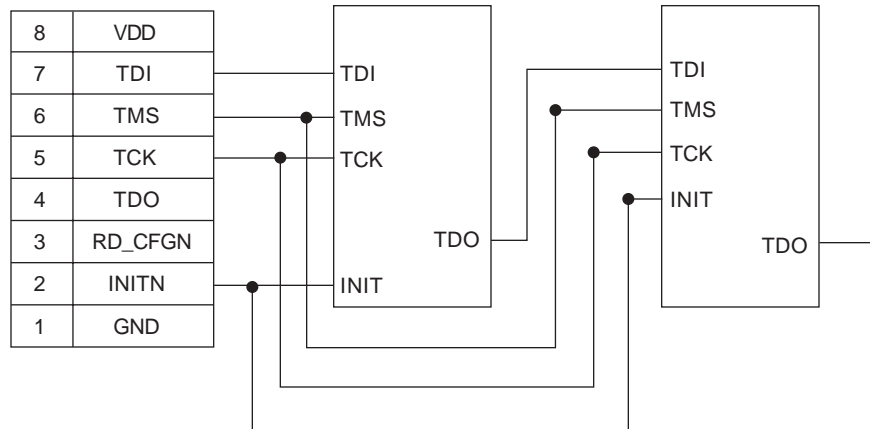
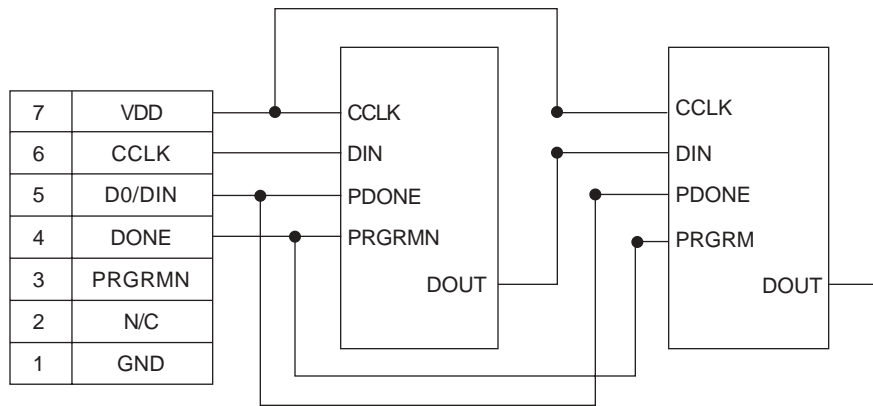


Figure 3. Daisy Chain Programming Example Using Serial Mode



The ORCA Download Cable supports 9,600 to 115,200 baud rates. The host computer transmits serial data to the module which forwards the correct programming format to the device being programmed. The interconnections between the module and device provides both status and control handshaking to the host computer.

The Cable is furnished with both male and female DB-25 pin connectors. This connector can be connected directly to the serial tty ports of Unix workstations. The DB-25 connector can be connected to the serial port of the PC. If the serial DB-25 is not available, the 25-pin connector can be converted to a DB-9 pin connector by using a DB-25 to DB-9 converter connected to a PC serial (COM) ports. This converter does not come as a part of the ORCA Download Cable. Users must procure these convertors themselves.

The connection for DB-25 and DB-9 are given in Table 1.

Table 1. Serial Port Connections

DB-25	DB-9
Pin 2	Pin 3
Pin 3	Pin 2
Pin 4	Pin 7
Pin 5	Pin 8
Pin 6	Pin 6
Pin 7	Pin 5
Pin 8	Pin 1
Pin 20	Pin 4
Pin 22	Pin 9

On the PCB side, the download module is furnished with two sets of wire-leads. Both can be connected to host boards using 0.100" receptacle assemblies such as AMP P/N 103903-7 and 103903-8 respectively. The 7-pin assembly provides all the connections needed for programming in the slave serial mode and the 8-pin assembly provides the connections for programming in the JTAG mode.

The cable has two primary connections from the download module to the PCB. The module is connected using edge-type connections through a set of flywires for either serial or JTAG programming. Another option connects the module to a JTAG dongle that easily adapts the cable to a standard 2x5 surface mounted header.

Tables 2 and 3 list the interconnections between the host board and the download module for the JTAG and slave serial modes, respectively.

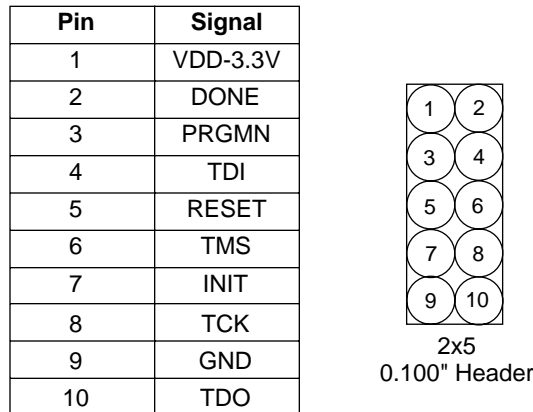
Table 2. AMP P/N 1039067, 8-Pin JTAG Interconnection

Pin	Signal
8	VDD
7	TDI
6	TMS
5	TCK
4	TDO
3	RD_CFGN
2	INITN
1	GND

Table 3. AMP P/N 1039066, 7-Pin Serial Interconnection

Pin	Signal
7	VDD
6	CCLK
5	D0/DIN
4	DONE
3	PRGRMN
2	N/C
1	GND

A 2x5 0.100" header can be used in place of the fly connectors to provide the JTAG connections. This typically utilizes less board space and permits a lower profile connection point. The recommended interconnections and the header diagram are given below.

Figure 4. Recommended 2x5 Header Connection

Software Instructions

The ORCA Download Cable programs the device using configuration bit streams or EPROM image files created by ORCA Foundry BITGEN and PROMGEN utilities. Once the user creates the programming file, the device programmer DEVPROG utility will program the device or devices on the host board using these simple steps:

- Create a bit stream file or PROM image file using either BITGEN (in .bit or .rpt format) or PROMGEN (in .mcs, .tex, or .exo formats). Additional information pertaining the configuration and bit stream generation can be found in technical note number TN1013, *ORCA Series 4 FPGA Configuration*.
- Connect download cable to the board. Make sure that the host PCB must be powered up before connecting the cable.
 - To Unix Workstation using the DB-25 pin connector and connecting to ttya or ttyb port.
 - To PC using the serial DB-25 port or by adapting DB-25 to DB-9 connector and connecting to serial COM port.
- Connect download leads to host board using serial or JTAG connections
- Power up host board, download module, green LED will illuminate
- Using the following device programmer instructions, begin programming the device.

Note: To insure successful programming, make certain proper selection of communication baud rate and ports are correct.

Invoke the device programmer - DEVPROG

Command line examples:

```
devprog -c serial -p COM1 example.bit
  -programming one ORCA device via serial mode

devprog -c serial -p COM1 -j w example.bit
  -programming one ORCA device via JTAG

devprog -c serial -p a -j w exampleA.bit exampleB.bit
  -programming multiple ORCAs via jtag form ttya port
```

The device programmer software can be invoked from the system prompt using the following command line options or from the ORCA Foundry Control Center interface which will allow easy option selection. The DEVPROG utility has options to use older download cables.

DEVPROG: Device Programmer ORCA Foundry
 Copyright (c) 1991-1994 by NeoCAD Inc. All rights reserved.
 Copyright (c) 1995 AT&T Corp. All rights reserved.
 Copyright (c) 1996-2001 Lucent Technologies Inc. All rights reserved.
 Copyright (c) 2001 Agere Systems, All rights reserved.
 Copyright (c) 2002 Lattice Semiconductor Corporation, All rights reserved.

Usage: devprog [-a <arch>] [-d <device>] [-b 1200|9600|19200|38400|57600|115200]
 [-c serial|luc|neo|SERIAL|LUC|NEO] [-p <port>] [-j w|r] <file> {<file>}

Where:

-a <arch>	Device architecture which is needed only for PROMs and JTAG readback.
-d <device>	Device part required for JTAG readback.
-j w r	JTAG download/readback
-c serial luc neo	Download cable type: serial for serial, luc for ATT/Lucent, neo for NeoCAD.

Note: This application note pertains only to the serial option listed above. DEVPROG is backward compatible to older version cables.

-b <speed> baud rate ranges, (defaults are maximum rates):

	Minimum	Maximum
Serial cable:	19200	115200
Lucent cable:	1200	9600
NeoCad cable:	1200	38400

-p <port> port device, defaults are:

PC: COM2
 Solaris: a

<filename>[.ext] where valid extensions are:

bit	ORCA binary bitstream file (default)
rbit	ORCA ASCII bitstream file
mcs	Intel PROM file
exo	ExorMax PROM file
tek	TekHex PROM file
xxx	readback file

Once programming starts, the LED on the module will illuminate red for serial programming or yellow for JTAG downloading. When programming is completed, the LED will return to green. The device programmer software handshakes with the cable to assure that the device is properly connected to the cable prior to transmitting the configuration data to the device. If these connections are not valid, the routine will display an error at run time on the host computer.

When using the cable to serially download to multiple ORCA devices, the user can accomplish this without any extra format changes to the source file. For example:

```
devprog -c serial exampleA.bit exampleB.bit
```

Using the above example, exampleA.bit will program the first device in the daisy chain and exampleB.bit would program the second, following sequentially with more devices. This format is the same in both JTAG or serial programming.