



CLEAR LOGIC

ELIMINATING THE SERIAL EPROM FROM FLEX 8000 DESIGNS

Introduction

Clear Logic's CL8000 family of Laser-Configured ASICs (LASICs) are designed for socket-compatibility with Altera's FLEX 8000 family of Field Programmable Gate Arrays (FPGAs). However, since the LASIC device is not programmable, it does not require the use of a configuration EPROM. This application note describes how to use LASIC technology to eliminate the need for (and unnecessary cost of) a configuration EPROM.

Background

Clear Logic CL8000 family products are fully compatible with Altera products both during system operation (run time) and during the configuration loading cycle. The CL8000 family supports all six of the configuration loading modes that can be used for the FLEX 8000 family. CL8000 family products also support a seventh, "Instant-On," mode that allows removal of configuration EPROMs from the system.

For use with a single serial configuration EPROM, the FLEX 8000 device often uses "Active Serial" configuration mode. The Altera FLEX determines its configuration mode by the logic levels on pins MSEL0, MSEL1, and nS/P. The CL8000 LASIC, when configured for operation in Active Serial configuration mode, is socket-compatible with the FLEX 8000 device.

Mixed Altera and Clear Logic parts require that the CL8000 be configured to the appropriate Altera compatible configuration mode. Otherwise, a configuration error will result.

Selecting Configuration

Within the CL8000 family there are two ways configuration is determined. For the CL8452A and the CL81188A, the configuration mode must be specified on the first article request form.

For other CL8000 family products, customers only specify Instant-On mode using the first article form. If Instant-On mode is not specified, the CL8282A, CL8636A, CL8820A, and

the CL81500A select an Altera compatible mode based upon the state of the configuration mode pins nS/P, MSEL0, and MSEL1. The mode selection table is identical to that of Altera. See Table 1, Application Note CL8K02. Specifying Instant-On mode overrides any other configuration mode selection.

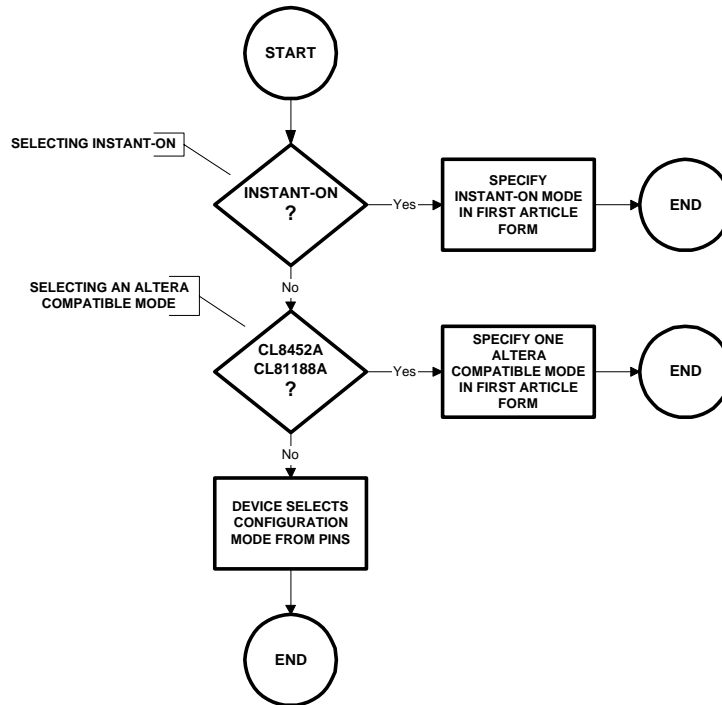


Figure 1. Customer Selection of CL8000 Family Configuration Mode

Instant-On Configuration

Instant-On mode may be used in systems where Clear Logic CL8000 devices are not mixed with Altera FLEX parts in the configuration loading chain. Altera parts and Clear Logic Instant-On parts may only be mixed on the board if the Altera parts are configured using a separate configuration EPROM loading chain.

In systems where all of the FPGAs have been replaced with CL8000 Instant-On devices, the serial EPROM can be removed. No changes to the PC board or software are needed.



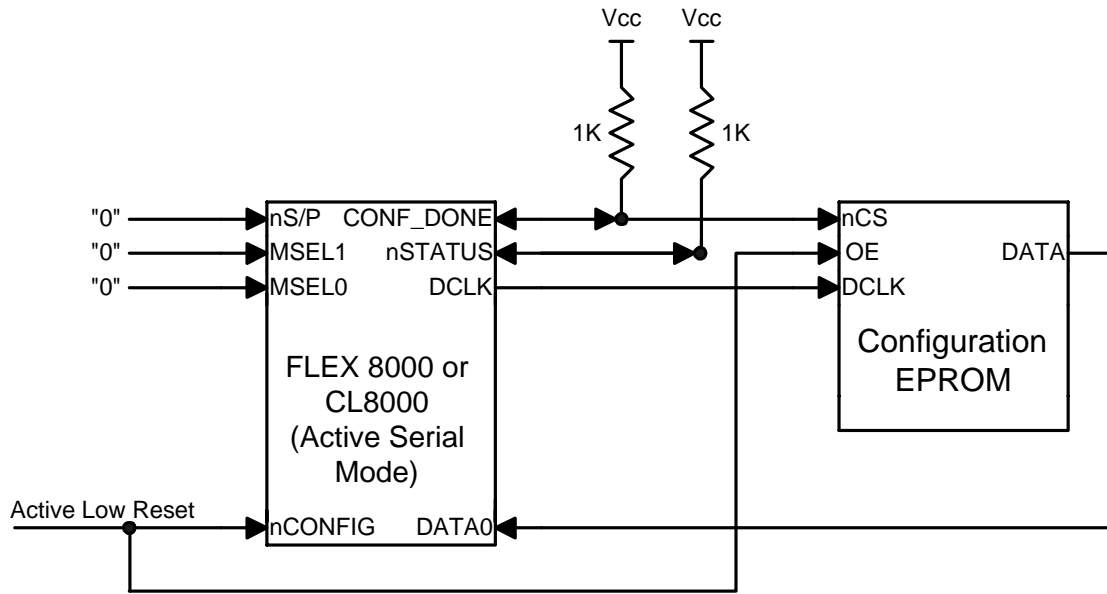


Figure 2. Altera FLEX 8000 Active Serial Configuration Circuit

Mixed Altera and Clear Logic parts require that the CL8000 be set to the appropriate Altera compatible configuration mode. Otherwise an error will be generated that will prevent the CONF_DONE pin from going to the "TRUE" state.

**Instant-On
Details**

Clear Logic products having the Instant-On mode selected perform a very short configuration cycle. After initiating a configuration loading sequence (see Appendix), the part counts one DCLK cycle. Then it immediately releases the open drain CONF_DONE pin, allowing it to be pulled high through an external resistor to Vcc. In the configuration circuit recommended by Altera, all FLEX products loading from the configuration EPROM have their CONF_DONE pins tied together in a wired-OR connection.

In this way, systems that have a checking mechanism for successful configuration will be able to detect a high level on the wired-OR connection of all CONF_DONE pins as showing successful configuration. Even though the Clear Logic CL8000 part does not really load a configuration, it does provide the external indication that it was successfully configured.



Clear Logic products in the Instant-On mode do not respond to the pin DATA0. Any level changes on this pin caused by removing the configuration EPROM will be ignored.

Circuit Board Changes Are Not Required

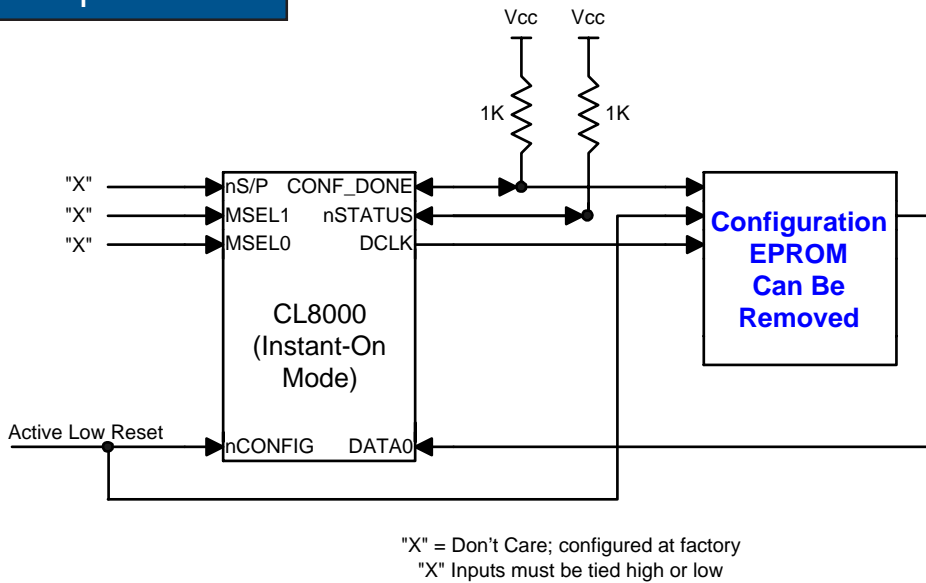


Figure 3. Clear Logic Configuration Circuit for "Instant-On" Mode

Instant-On mode is designed to allow customers to remove the serial configuration EPROM with no changes to the printed circuit board.

The nCONFIG pin is used to initiate configuration loading. There are two cases to consider for this signal. In Case 1, the pin may be connected to an active low system reset as shown in Figure 3. If the active low reset is connected, it will be used to initiate the "Instant-On" configuration cycle. See Figure 4, the simplified equivalent circuit for this situation. Since the active low reset connection to nCONFIG is the same as it would be with a configuration EPROM in the system, no printed circuit board change is needed.



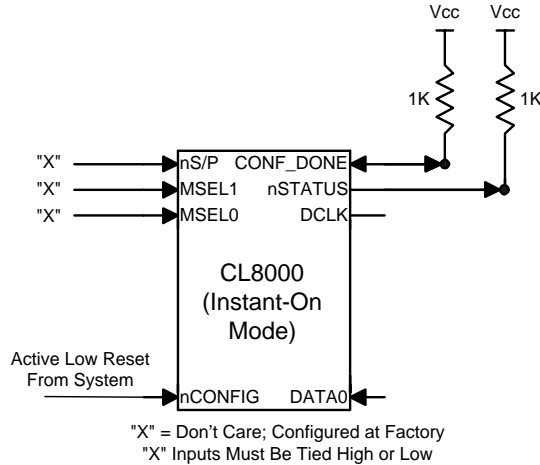


Figure 4. Equivalent Circuit With Active Low Reset (Case 1)

In Case 2, there is no system reset driving the nCONFIG pin. See Figure 5. In this case, Altera recommends that the nCONFIG pin be tied to Vcc. This connection insures that the nCONFIG input will pull to a high level at power up, allowing the Instant-On configuration cycle to begin. When the system powers up, the CL8000 internally detects power-on and initiates a configuration loading sequence. Again, there is no change to the connection to nCONFIG.

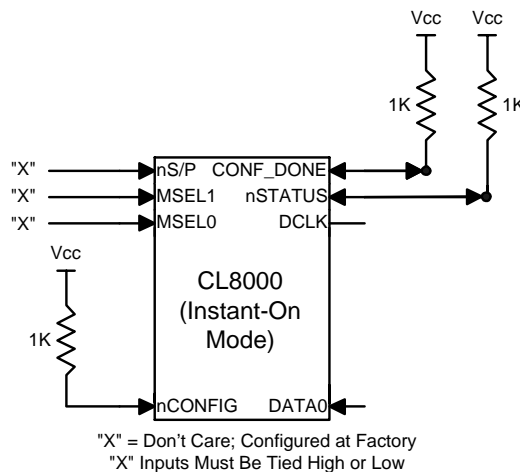


Figure 5. Equivalent Circuit With No System Reset (Case 2)



In either Case 1 or Case 2, the CL8000 initiates a configuration cycle similar to the FLEX 8000 sequence. In less than one microsecond, the CL8000 signals successful configuration by releasing the open drain CONF_DONE pin.

In systems with more than one FPGA, all of the CONF_DONE pins from each FPGA can be connected as wired-or. In this case, the connection is held low until all FPGAs have released their CONF_DONE signals. The wired-or node then pulls high. Because the CONF_DONE signal is bidirectional, each FPGA senses the high on CONF_DONE. This begins the initialization sequence of all FPGAs at the same time.

During the next ten cycles of DCLK the device initialization is performed as specified by the Device Configuration Option Bits. The Device Configuration Option Bits are in the bitstream that Clear Logic used to factory configure the device. Initialization settings that the FLEX 8000 device loads (tri-state I/O control, etc.) are duplicated in the Clear Logic device. Since the CL8000 requires no data or control signals from the serial EPROM, no circuit board changes are required.

Summary

When factory-configured with the appropriate FLEX 8000 compatible configuration mode, the CL8000 LASIC is socket-compatible with the corresponding FLEX 8000 device. CL8000 LASIC devices are also equipped with a specialized configuration mode, Instant-On, which allows the serial EPROM to be eliminated. Elimination of the EPROM requires no changes to the printed circuit board.



Appendix

Pin Functions Used For Configuration Loading In The CL8000 Family

Pin	Type	Function
nCONFIG	Input	Low to High Starts Configuration
CONF_DONE	Open Drain	Release Signals Configuration Done Pin is Bi-Directional; High Begins Initialization
nSTATUS	Output	Low Signals Unsuccessful Configuration
DCLK	Output	Clock for Serial EPROM Data
nS/P	Input	Selects Configuration Mode **
MSEL0	Input	Selects Configuration Mode **
MSEL1	Input	Selects Configuration Mode **

** Except CL8452A and CL81188A for which configuration mode is factory programmed.

Instant-on Configuration Loading Sequence

- 1. System Reset or Internal Power-on Detect Initiates Configuration**
- 2. After 1 DCLK Cycle, CL8000 Releases Open Drain CONF_DONE Pin**
- 3. CL8000 Starts Initialization Sequence When CONF_DONE Is High**
- 4. CL8000 Counts 10 DCLK Cycles (Approximately 2.5 µsec)**
- 5. Initialization Is Done**

Revised: May, 1998

© Clear Logic, Inc., May, 1998. Clear Logic, the Clear Logic logo, CL8000, and LASIC are trademarks of Clear Logic, Inc. Altera, FLEX, and FLEX 8000 are trademarks of Altera Corporation. All other trademarks are the property of their respective owners. Clear Logic reserves the right to make changes without notice to any products herein. Clear Logic makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does Clear Logic assume any liability arising out of the application of any product, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Clear Logic does not convey any license under its patent rights nor the rights of others. Clear Logic products are not designed, intended, or authorized for use in applications intended to support or sustain life, or for any other application for which the failure of the Clear Logic product could create a situation in which personal injury or death may occur.

