



CYPRESS

## Converting Designs from FLASH370i™ to Ultra37000™ Devices

### Introduction

This application note addresses the issues associated with upgrading a design from a FLASH370™ or a FLASH370i™ device to an Ultra37000™ device. The Ultra37000 family of devices are superset replacements for the FLASH370 and FLASH370i devices, though there are some differences between the FLASH370 and FLASH370i families and the Ultra37000 family that need to be understood to determine whether there will be any functional differences when upgrading. The main difference between the FLASH370i and the Ultra37000 pertains to the enabling of the JTAG four-pin programming interface. It is suggested that the following two application notes, "An Introduction to In System Reprogramming with the Ultra37000", and "An Introduction to In System Reprogramming with the FLASH370i" be read along with this application note for a detailed understanding of the two product families.

### JTAGen (ISRen) Enables the 4-pin JTAG Interface

The JTAG interface consists of four pins which are defined in the IEEE 1149.1 standard. For the Ultra37000 family there may be an additional pin, called JTAGen, depending on the package. This function of this pin is only to select the JTAG function or the I/O function on those packages where the JTAG pins share their functionality with I/O pins. For the FLASH370i family this pin, called ISRen, performs the same function as in the Ultra37000 family but additionally serves as the high voltage programming pin. Some of the packages of the Ultra37000 family incorporate the JTAGen pin, when the JTAG pins share their functionality with I/O pins, and other members of the family do not have this pin, when the JTAG pins perform only JTAG functions.

For the Ultra37000 devices, when this pin is at a TTL HIGH level the JTAG pin functionality is selected, and when it is at a TTL LOW, the I/O pin functionality is selected. For the FLASH370i devices, the JTAG pin functionality is selected when it is at a supervoltage of 12V and the I/O pin functionality is selected when it is at a TTL level between 0 and 5V. This functional difference between the JTAGen pin on the Ultra37000 family and the ISRen pin on the FLASH370i family may cause a functional difference when a Ultra37000 device replaces a FLASH370i device. The difference only occurs if the user is using the I/O function on the JTAG/I/O pins. This difference is inherent in the technologies of the two CPLD families where the Ultra37000 family is 5V EEPROM and the FLASH370i is 12V FLASH.

### Determining if a FLASH370i Design Will Convert to an Ultra37000 Device

Converting a design from the FLASH370i device to the Ultra37000 device requires that the following procedure be followed to determine if any functional problem exists:

1. Check to see if the FLASH370i design uses a package where the JTAG pins share their functionality with I/O pins, referred to as a dual-function package. If the JTAG pins are standalone, referred to as a single-function package, then the user does not need to worry about any functional differences when upgrading to the Ultra37000. If the device is dual-function then proceed to step 2.
2. Check to see if the design uses the I/O function on any of the JTAG/I/O pins. If none are used then the user does not need to worry about any functional differences when upgrading to the Ultra37000. If any of these I/Os are being used then proceed to step 3.
3. Check the biasing on the JTAGen (ISRen) pin. If this pin is tied LOW then no functional problems will result from upgrading to Ultra37000. If the pin is tied HIGH then the I/O function on the JTAG/I/O pin will not be selected and there will be a functional difference resulting on the Ultra37000 device. In this case the board design must be changed to force the JTAGen pin LOW when the device operates in functional mode. If the pin is floating then the weak internal pull-down device on the JTAGen pin will keep the pin in the LOW state in most applications and the functionality of the board remains the same as the FLASH370i devices. (The pull-down device is available on all dual function members of the Ultra37000 family with the exception of early silicon on the Ultra37256P160 devices.) While the pull-down device is adequate in most cases there may be some applications where the weak pull-down is not adequate to maintain the LOW state. Such an example is if the device exists in the same chain with other FLASH370i devices. It may therefore be necessary to drive this pin externally LOW.

Two methods for driving the JTAGen pin LOW, using a pull-down resistor and using an external component are presented in the application note "Designing With Cypress In System Reprogrammable™ (ISR™) CPLDs for PC Cable Programming." If a pull-down resistor is used, the user needs to pay attention to the value of the pull-down resistor because the pull-down resistor must overpower a bus-hold latch attached to the JTAGen pin. If the user is programming the devices via ISR instead of a third-party programmer then there may be multiple devices placed in the ISR chain. In this case the pull-down will need to be a lower resistance value in order to overpower multiple bus-hold latches ganged together in parallel.

While most designs will convert from the FLASH370i to the Ultra37000, there may also be some older FLASH370 (non-i)

designs that may need to be converted to the Ultra37000 devices.

### Determining if a FLASH370 (non-i) Design Will Convert to an Ultra37000 Device

The FLASH370 family is architecturally the same as the FLASH370i family but does not include the ISR interface and the bus-hold feature. The addition of the ISR interface required a supervoltage programming pin that replaced one of the dedicated input pins. In the FLASH370i family this pin is called the ISRen pin. In the Ultra37000 family the same pin is called JTAGen and, similar to the FLASH370i family, also does not function as an input pin. Therefore the user needs to check the design to make sure that the ISRen/JTAGen pin equivalent on the FLASH370 device is not being used as a functional input in the design. *Table 1* shows the location of this pin for all relevant dual-function packages.

**Table 1. Location of ISRen/JTAGen Pin**

Package	ISRen/JTAGen Pin
44-pin PLCC	11
44-pin TQFP	5
84-pin PLCC	81
160-pin TQFP	139

Since the FLASH370 family does not have ISR, it is considered more likely that the design will be using I/O pins that share their functionality with ISR pins on the Ultra37000 equivalent device. It is therefore important that the previously described procedure be followed to make sure the JTAGen pin is biased in the correct LOW state, if necessary, to choose the I/O function on the JTAG/IO pins.

### JEDEC Translator

The *Warp*™ software provides a DOS or Unix utility for converting a JEDEC file of a FLASH370 or FLASH370i device to a JEDEC file of a Ultra37000 device. A file called "jedec-man.pdf" under the /doc directory under the *Warp* installation directory provides documentation on how to use the JEDEC converter called "jtrans". While the documentation does not mention the conversion of FLASH370 (non-i) to Ultra37000, this feature is supported and will work fine provided the input pin that converts to the JTAGen pin is not being used in the FLASH370 design.

### Summary

Single-function mode Ultra37000 devices, those without a JTAGen pin, directly replace FLASH370i devices with no conversion issues. Replacing dual-function FLASH370i devices, those with ISR pins that share their functionality with I/O pins, with Ultra37000 devices works provided the FLASH370i design does not use the I/O function of the dual-function pins. It also works if the I/O function is being used on these pins and the JTAGen pin is driven LOW so the I/O function on the dual-function pins is selected and not the JTAG function.

In addition to the biasing of the JTAGen pin, one additional check must be made when converting FLASH370 (non-i) devices to Ultra37000 devices. When ISR was added to the FLASH370 family creating the FLASH370i, one of the dedicated input pins was used instead only as the ISRen function. Like the FLASH370i, for the Ultra37000 devices the pin only functions as a JTAGen pin, assuming the device is a dual-function package and the pin exists, hence no input function on this pin is possible. Design modification is necessary if this pin was originally used as an input in a FLASH370 design.

A JEDEC converter utility is available from *Warp* to convert designs from the FLASH370 or FLASH370i devices to the Ultra37000 device.

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