

# Hyperstone F2 and F3 NAND Controllers/SkyHigh NAND – Enhancing Power Fault Tolerance

Author: Cypress

Power fault tolerance is a requirement of any modern system using flash. It is largely accomplished by software/firmware managing the flash. This application note describes a method of connecting the flash to improve the system's power fault tolerance.

## 1 Introduction

Power Fault testing for any system that programs and erases flash is important. The system must be able to boot and recall data after unexpected power failures interrupt flash operations.

The Hyperstone F2 and F3 generation NAND controller have built in power fault tolerance. The modification described within this application note will enhance the power fault tolerance of systems based on SkyHigh 3V NAND and the Hyperstone F2 or F3 controllers.

This modification increases the chance for the NAND to complete the last operation by allowing the flash to continue to run (until  $V_{CC} = \sim 1.5V$ ) after the controller has already stopped ( $V_{CC} = \sim 2.5V$ ). If the time between  $V_{CC} = 2.5V$  and  $V_{CC} = 1.5V$  exceeds 200  $\mu s$ , the flash should always finish to the last program operation. By allowing the flash's last program operation to complete, the page's data retention time can reach its full potential.

Extensive random power fault tests will occasionally cut power at a time when the data verifies correctly, but the retention time is indeterminate because the program operation did not fully complete. This condition defeats the controller's power fault tolerance algorithm. This will lead to uncorrectable bit failures when the pages are accessed later in the test. Systems with an appropriate power decay rate and the following modification will avoid this condition.

## 2 Required Modification

The Hyperstone F2 and F3 controllers assert the flash WP# pin for a synchronized shutdown of the controller and flash. We recommend cutting this connection and connect the WP# pin to  $V_{CC}$  through a pull up resistor.

## Document History Page

Document Title: AN98557 - Hyperstone F2 and F3 NAND Controllers/SkyHigh NAND – Enhancing Power Fault Tolerance				
Document Number: 001-98557				
Rev.	ECN No.	Orig. of Change	Submission Date	Description of Change
**	-	-	02/11/2013	Initial version
*A	-	-	03/08/2013	Changed 'pulling the WP# pin' to 'connect the WP# pin' in the Required Modification section
*B	4888315	JHOE	08/18/2015	Updated in Cypress template
*C	5822820	AESATMP8	07/18/2017	Updated logo and Copyright.
*D		MNAD	06/03/2019	Updated to SkyHigh format.