Undershoot Effect in RTC Circuit of 0.25μ nvSRAM

AN49947

Associated Part Family: CY14BXXXK/STK17TX8
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Application Note Abstract

This application note describes the undershoot effect in the RTC circuit of the 256K and 1M nvSRAM in 0.25μ technology. The part numbers affected are CY14B256K/STK17T88 and CY14B101K/STK17TA8.

Introduction

Under certain noise conditions, the Real Time Clock (RTC) circuit of CY14BXXXK/STK17TX8 can be disturbed to the point that the oscillator circuit stops.

Undershoot in Application

The RTC devices in 0.25μ specify in the data sheet that inputs may not undershoot by more than –0.5V. This is difficult to achieve in systems where signal fall times are fast (1 to 3 ns). As a result of these fast fall times, signal undershoot greater than –0.5V is quite common.

Signal undershoot greater than –0.5V causes the ESD diodes on the device inputs to conduct current. This current travels through the substrate until it reaches collection points (guard bands with substrate contacts). However, as this current flows within the substrate, it adds noise to the overall noise floor on the device.

Figure 1. Signal Undershoot
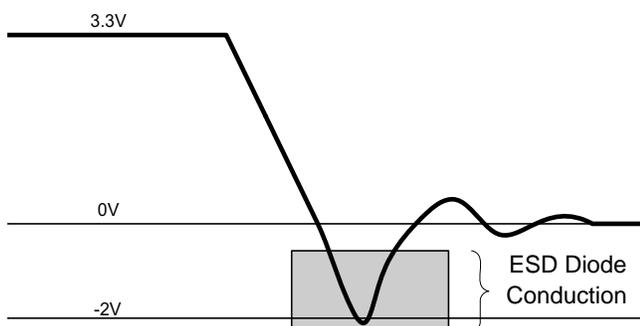
Effect on RTC Oscillator

The RTC oscillator circuit, which is embedded on the 256K and 1M nvSRAM family is designed to be a very low power circuit. To achieve this low power operation, the automatic gain circuit of the oscillator is designed to operate on very small currents (nano-Amperes). This makes the gain circuit sensitive to on-chip noise, which in turn makes the RTC oscillator circuit very sensitive to substrate currents caused by signal undershoot.

There have been reports of the oscillator stopping in some customer systems. Investigation showed that these systems all had a significant amount of undershoot. Correcting the undershoot on the input pins corrected the problem. The address pins A_0-A_3 and data pin DQ_0 are located in the area of the RTC oscillator circuit. Undershoot on these address pins has the greatest effect on the RTC circuit operation. It is recommended that customers experiencing similar problems investigate and correct undershoot issues.

Recommendation

Undershoot can be reduced by adding a Schottky diode ($V_F <$ 0.4V with I_F at 100 mA) connected with the anode at ground and cathode on the signal line as close to the device pin as possible. Layout must route the signals to connect to the diode first then the pin if possible. The anode to ground should go directly to the ground plane. The only signals that require this treatment are A_0, A_1, A_2, A_3, and DQ_0. A scope must be used to confirm controlled undershoot as some fast edge rates may need more effective termination. It is critical that the voltage does not go below 0.6V as substrate currents begin to flow.

Document History

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**	2606848	NXR	11/13/08	New application note

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