HS-303xxH, HS-302AEH

Design for Single Event Transients

Abstract

The intense proton and heavy ion environment encountered in space applications can cause a variety of Single Event Effects (SEE) in electronic circuitry, including Single Event Transients (SET). This document explains how the charge deposited by a heavy ion with an LET of 60MeV•cm^2/mg striking the chip at a 60° angle does not cause a transient event of sufficient magnitude to be considered a change of state.

Related Literature

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- HS-303ARH, HS-303AEH, HS-303BRH, HS-303BEH, HS-303CEH, HS-302AEH device pages

Description

Pass/Fail Criteria: The off switch transfers less than 150pC into the output capacitor for ions of up to 60MeV•mg/cm^2 at up to 60° incidence from normal to the surface of the chip. This matches the switching charge injection specification of 150pC (15mV delta with a 10nF load cap).

Only the off switch being upset to “ON” needs to be simulated. A momentary (~tens of ns) glitch “off” of an on switch is insignificant as compared to the switch’s normal on-time. With 500ns delay specifications, the applications have on and off times in the µs range or higher.

Calculation of total charge to be simulated (ref. Peterson, IEEE NSREC short course, 1983):

Deposited Energy = (LET)(Silicon Density)

= (60MeV•cm^2/mg)(2.33x10^{3}mg/cm^3)(1cm/1x10^{4}µm)

= 13.98MeV/µm

Deposited Charge = Deposited Energy * q/W_{ehp}

= (13.98MeV/µm)(1.6x10^{-19} C/electron) (1 electron/3.6eV)(1x10^{6}eV/MeV)(1x10^{12}pC/C)

= 0.62pC/um

For the Radiation Hardened Silicon Gate (RSG) process with a maximum Dielectrically Isolated (DI) island depth of 20µm and a particle incidence of 60°, the ionization track is 40µm long. Therefore, assuming the particle has a high enough energy to penetrate this far and 100% charge collection, the total charge is 24.85pC. This is significantly less than the charge injected from a switching transient.

Revision History

Rev.	Date	Description
1.00	Jul.25.19	Initial release

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