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Space environment-Method of single event upset rates prediction of semiconductor devices for space applications

空间环境 宇航用半导体器件在轨单粒子翻转率预计方法

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting is required.

Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents.

This document was proposed by the Chinese Academy of Sciences.

This document is under the jurisdiction of the National Technical Committee on Aerospace Technology and Its Applications Standardization (SAC/TC 425).

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Space Environment Semiconductor Devices for Spaceflight in Orbit Single Event Upset Rate Prediction Method

1 Scope

This document describes the method for conducting on-orbit single event upset rate estimation of semiconductor devices for space flight (hereinafter referred to as "devices"), including the original The main functions of the project are as follows. theory, process, calculation of LET spectrum of space charged particles and proton energy spectrum, processing and analysis of irradiation test data and prediction of single particle upset rate.

This document is applicable to the prediction of single event upset rate of devices caused by protons and heavy ions in the natural radiation environment of space.

This document is not applicable to the prediction of single-particle upset rates caused by high-energy electrons.

2 Normative references

GB/T 32452

GB/T 41206-2021

GB/T 44001

3 Terms and definitions

The terms and definitions defined in GB/T 32452 and the following apply to this document.

3.1 Linear Energy Transfer; LET

The energy deposited by a charged particle per unit length along its track.

Note. The commonly used unit is mega-electron volt square centimeter per milligram (MeV-cm2/mg).

3.2 threshold LET

The minimum LET value required for a device to experience a single event event.

3.3 SEU cross section

The number of single event upsets occurring per unit particle fluence.

Note. sigma = single-event upset number/(injection x costheta), where sigma is the single-event upset cross section, usually expressed in square centimeters per device (cm2/device), or square cm2/bit. theta is the angle between the ion incident direction and the surface normal of the device under test.

3.4 Saturation cross section

The single-event upset cross section at which the cross section no longer increases with increasing LET value of the incident particle.