

Process management for avionics — Atmospheric radiation effects —

Part 4: Guidelines for designing with high voltage aircraft electronics and potential single event effects

ICS 31.020; 49.060

National foreword

This Draft for Development is the UK implementation of IEC/PAS 62396-4:2007.

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature. It should be applied on this provisional basis, so that information and experience of its practical application can be obtained.

A PAS is a Technical Specification not fulfilling the requirements for a standard, but made available to the public and established in an organization operating under a given procedure.

A review of this Draft for Development will be carried out not later than 3 years after its publication.

Notification of the start of the review period, with a request for the submission of comments from users of this Draft for Development, will be made in an announcement in the appropriate issue of *Update Standards*. According to the replies received, the responsible BSI Committee will judge whether the validity of the PAS should be extended for a further three years or what other action should be taken and pass their comments on to the relevant international committee.

Observations which it is felt should receive attention before the official call for comments will be welcomed. These should be sent to the Secretary of the responsible BSI Technical Committee at British Standards House, 389 Chiswick High Road, London W4 4AL.

The UK participation in its preparation was entrusted to Technical Committee GEL/107, Process management for avionics.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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PROCESS MANAGEMENT FOR AVIONICS – ATMOSPHERIC RADIATION EFFECTS –

Part 4: Guidelines for designing with high voltage aircraft electronics and potential single event effects

1 Scope and object

This PAS is intended to provide guidance on Atmospheric Radiation effects on high voltage, nominally above 200 V. Avionics electronics used in aircraft operating at altitudes up to 60 000 feet (18,3 km). It is intended to be used in conjunction with IEC/TS 62396-1. This PAS defines the effects of that environment on high voltage electronics and provides design considerations for the accommodation of those effects within avionics systems.

This PAS is intended to help aerospace equipment manufacturers and designers to standardise their approach to Single Event Effects on high voltage Avionics by providing guidance, leading to a standard methodology.

Details are given of the types of Single Event Effects relevant to the operation of high voltage Avionics electronics, methods of quantifying those effects, appropriate methods to assist design and to demonstrate the suitability of the electronics for the application.

1.1 Normative references

The following referenced documents are indispensable for the application of this document, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC/TS 62396-1, *Process management for avionics – Atmospheric radiation effects – Part 1: Accommodation of atmospheric radiation effects via single event effects within avionics electronic equipment*

2 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC/TS 62396-1 apply.

3 Potential high voltage single event effects

A N-channel power MOSFET can have two different types of catastrophic effects induced by the deposition of charge from a single energetic particle, Single Event Burnout, SEB and Single Event Gate Rupture, SEGR. In addition to this kind of power MOSFET, other power devices, such as Insulated Gate Bipolar Transistors (IGBTs), bipolar power transistors and diodes, which have large applied voltage biases and high internal electric fields, are susceptible to SEB. In SEB, the penetration of the source-body-drain region by the deposited charge can forward bias the thin body region under the source. If the bias applied to the drain exceeds the local breakdown voltage of the parasitic bipolar elements, the single event induced pulse initiates avalanching in the drain depletion region that eventually leads to destructive burnout SEB. SEGR applies to N and P channel MOSFETS. It is explained via the transient plasma filament created by the energy deposition track when the MOSFET is struck through the thin gate oxide region. As a result of this transient track filament, there is a localized increase in the oxide field which can cause the oxide to break down, leading first to gate leakage and finally to gate rupture. As a consequence of the atmospheric neutrons, SEB is the major threat to high voltage electronics.