

## Electronic Component Specification

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### Distribution

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### Change Record

Issue	Dates	Pages Changed	Comments
1	5 Jul 01		New
2	10 Sept 01	All	General revision. New radiation information

## 1 Introduction

This note defines the selection standards for flight electronic components for the EIS instrument on the Solar-B mission. It refers to screening levels and radiation performance, and generally follows NASA recommendations.

## 2 Documents

NASA Parts Selection List: <http://nepp.nasa.gov/npsl/> (online selection)  
GSFC 311-INST-001: <http://epims.gsfc.nasa.gov/ctre/parts/inst/prd.htm> (downloadable file).  
MIL-M-38510  
MIL-PRF-38535  
MIL-STD-883E  
MIL-PRF-19500  
Established Reliability Specifications  
NASA Radiation Characterisation: <http://nepp.nasa.gov/erc/index.htm>  
Solar-B Radiation Document 16 Sept 1999. Various dose - depth curves.

## 3 Standards

Select standard parts in order of preference:

### 3.1 NASA Parts Selection List & GSFC 311-INST-001 level 2

Use a quality level of no lower than Grade 2 for the NPSL.

### 3.2 JANS and JANB microcircuits

Select to MIL-M-38510 class V and class Q, and MIL-PRF-38535, if not listed in the NPSL.

### 3.3 NASA Parts Selection List - new technology parts

### 3.4 MIL-STD-883E Level B

Hermetically sealed monolithic and hybrid microcircuits as per paragraph 1.2.1, either marked /883 or procured to Standard Military Drawings (SMD) Level M.

### 3.5 MIL-STD-883E or EIA/JEDEC based test programme

Manufacturer's own test programme based on these standards with a certificate of compliance.

### 3.6 JANTXV, JANTX, JANS

Semiconductor devices to MIL-PRF-19500

### 3.7 Established Reliability Specifications (ER)

Passive components procured to levels S and R.

### 3.8 Hermetically sealed industrial grade

Parts specified for -25C to +85C operation with additional supplier screening to GSFC 311-INST-001.

### 3.9 Others

Other parts are non-standard and their use will need to be justified.

## 4 Radiation Hardness

See NASA database at: <http://radhome.gsfc.nasa.gov/top.htm>.  
SEE (and SEU) info at: <http://radhome.gsfc.nasa.gov/papers/seespec.htm> (TBC)

### 4.1 Total Dose

The baseline total dose survivability requirement is 30krad.

A figure of 30krad also represents the minimum that a fabrication line with a known radiation performance should achieve. A dose margin of at least a factor of 2 should be used for the actual dose that a part may receive inside any screening. Using the Solar-B dose-depth curves, this implies a minimum shield thickness of 1.6mm of aluminium or equivalent.

### 4.2 SEE

NASA defines single event effect (SEE) as any measurable effect to a circuit due to an ion strike, and includes a single event upset (SEU) and latchup in the definition.

SEE immune is defined by NASA as a device having an LET<sub>th</sub> > 100 MeV cm<sup>2</sup> / mg.  
(LET<sub>th</sub> = Linear Energy Transfer threshold).

(Instead of MeV cm<sup>2</sup> / mg, units of MeV / mg / cm<sup>2</sup> are often used, and mean the same.)

#### 4.2.1 SEU

If a device is not immune as in this definition, analysis of the expected SEU rates will need to be done.

#### 4.2.2 Latchup

Only parts immune as in this definition, or parts using a process immune to latchup, should be used. Any other parts will require use of current limiters to prevent damage in the case of latchup. An assessment of the likely disruption rate to the instrument will also be necessary, as a power cycle will be necessary to recover normal operation.

For cosmic ray flux the intensity rises steeply below about 37MeV cm<sup>2</sup> / mg. This effectively creates a lowest acceptable limit for part specification for the LET latchup threshold. The value probably corresponds to the range of energies of trapped particles in the Earth's radiation belts.

### 4.3 ICU Screening

The ICU housing design is on average 2.0mm thick over the box (as of Sept 01). In addition, the spacecraft bus structure will provide an extra (TBD) amount of screening through the side opposite the mounting face. Adjacent electronics boxes also will offer some extra screening.

From the Solar-B dose-depth curves, this implies a total dose of about 2.2krad per year, or about 11krad over 5 years, just taking into account the 2.0 mm housing. This is a reasonable dose margin for a nominal 30krad part.

### 4.4 Parts Selection Radiation Summary

Total dose rating of 30krad minimum.

LET threshold for SEU of 100MeV cm<sup>2</sup> / mg minimum. Analyse expected SEU rate below this.

LET threshold for latchup of 100MeV cm<sup>2</sup> / mg minimum. Use current limit protection for values below this. Do not use parts specified to be below 37MeV cm<sup>2</sup> / mg for latchup.