

# Radiation Report

## **SN54SC8T573-SEP Production Flow and Reliability Report**

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### **ABSTRACT**

This report presents the reliability and qualification results for the SN54SC8T573-SEP device, radiation tolerant octal transparent D-type latches with 3-state outputs in SEP (Space Enhanced Plastic). The SN54SC8T573-SEP device is manufactured with a controlled baseline and has the following:

- One assembly and test site
  - Product traceability
  - An extended product life cycle
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### **Table of Contents**

|  |          |
|--|----------|
| <b>1 Texas Instruments Enhanced Product Qualification and Reliability Report</b> ..... | <b>2</b> |
| <b>2 Space Enhanced Plastic Production Flow</b> .....                                  | <b>3</b> |
| 2.1 Device Introduction.....   | 3        |
| 2.2 SN54SC8T573-SEP Space Enhanced Plastic Production Flow.....                        | 3        |
| <b>3 Device Qualification</b> .....  | <b>4</b> |
| <b>4 Outgas Test Report</b> .....  | <b>5</b> |

### **List of Figures**

|   |   |
|---|---|
| Figure 2-1. SN54SC8T573-SEP Space Enhanced Plastic Production Flow Chart..... | 3 |
|---|---|

### **List of Tables**

|   |   |
|---|---|
| Table 3-1. Space Enhanced Products New Device Qualification Matrix..... | 4 |
| Table 4-1. Outgas Test Results.....                                     | 5 |

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## **1 Texas Instruments Enhanced Product Qualification and Reliability Report**

TI qualification testing is a risk mitigation process that is engineered to assure device longevity in customer applications. Wafer fabrication process and package level reliability are evaluated in a variety of ways that may include accelerated environmental test conditions with subsequent derating to actual use conditions. Manufacturability of the device is evaluated to verify a robust assembly flow and assure continuity of supply to customers. TI Enhanced Products are qualified with industry standard test methodologies performed to the intent of Joint Electron Devices Engineering Council (JEDEC) standards and procedures. Texas Instruments Enhanced Products meet GEIA-STD-0002-1 Aerospace Qualified Electronic Components.

## 2 Space Enhanced Plastic Production Flow

### 2.1 Device Introduction

SN54SC8T573-SEP is a radiation hardened device in a plastic package which allows this device to be used in space applications. The device was verified immune to  $43\text{MeV} \times \text{cm}^2 / \text{mg}$  at  $125^\circ\text{C}$  for single event latch-up (SEL). Each fabrication lot was tested according to MIL-STD-883 for Radiation Lot Acceptance Tested (RLAT) up to 30krad(Si) and each assembly and test lot follows the process flow shown in Figure 2-1. To maintain the quality of SN54SC8T573-SEP, the device is qualified with Space EP requirements. See Section 3 for further details.

### 2.2 SN54SC8T573-SEP Space Enhanced Plastic Production Flow

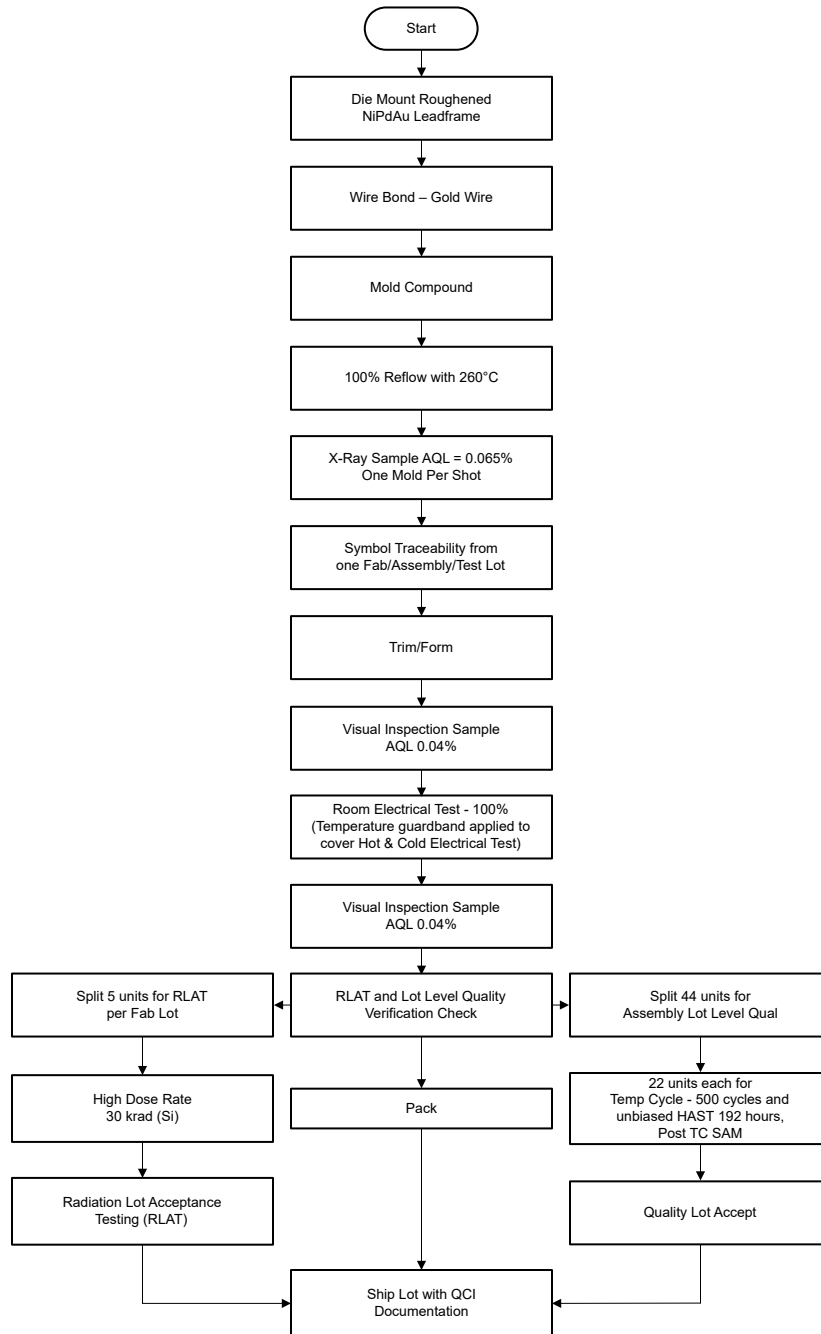


Figure 2-1. SN54SC8T573-SEP Space Enhanced Plastic Production Flow Chart

### 3 Device Qualification

The following is the device qualification summary.

#### Qualification by Similarity (Qualification Family)

A new device can be qualified either by performing full scale quality and reliability tests on the actual device or using previously qualified devices through *Qualification by Similarity* (QBS) rules. By establishing similarity between the new device and those qualified previously, repetitive tests are eliminated, allowing for timely production release. When adopting QBS methodology, the emphasis is on qualifying the differences between a previously qualified product and the new product under consideration.

The QBS rules for a technology, product, test parameters or package shall define which attributes are required to remain fixed for the QBS rules to apply. The attributes which are expected and allowed to vary are reviewed and a QBS plan shall be developed, based on the reliability impact assessment above, specifying what subset of the full complement of environmental stresses is required to evaluate the reliability impact of those variations. Each new device shall be reviewed for conformance to the QBS rule sets applicable to that device. See JEDEC JESD47 for more information.

**Table 3-1. Space Enhanced Products New Device Qualification Matrix**

| Note that qualification by similarity ( <i>qualification family</i> ) per JEDEC JESD47 is allowed. |  |                              |               |   |
|--|--|------------------------------|---------------|---|
| DESCRIPTION  | CONDITION  | SAMPLE SIZE USED/<br>REJECTS | LOTS REQUIRED | TEST METHOD                                 |
| Electromigration   | Maximum Recommended Operating Conditions   | N/A                          | N/A           | PerTI Design Rules                          |
| Wire Bond Life   | Maximum Recommended Operating Conditions   | N/A                          | N/A           | PerTI Design Rules                          |
| Electrical Characterization  | TI Data Sheet  | 10                           | 3             | N/A   |
| Electrostatic Discharge Sensitivity  | HBM per TI Datasheet   | 3 units/voltage              | 1             | JEDEC JS-001 or EIA/JESD22-A114             |
|  | CDM per TI Datasheet   |                              |               | JEDEC JS-002 or EIA/JESD22-C101             |
| Latch-up   | Per Technology   | 3/0                          | 1             | EIA/JESD78                                  |
| Physical Dimensions  | TI Data Sheet  | 5/0                          | 1             | EIA/JESD22- B100                            |
| Thermal impedance  | Theta-JA on board  | Per Pin-Package              | N/A           | EIA/JESD51                                  |
| Bias Life Test   | 125°C / 1000 hours or equivalent   | 77/0                         | 3             | JESD22-A108 <sup>1</sup>                    |
| Biased HAST  | 130°C/ 85% / 96 hours<br>or 110°C/ 85% / 264 hours<br>or 85°C/ 85% / 1000 hours                  | 77/0                         | 3             | JESD22-A110/A101 <sup>1</sup>               |
| Extended Biased HAST   | 130°C/ 85% / 192 hours (for reference)<br>or 110°C/ 85% / 528 hours<br>or 85°C/ 85% / 2000 hours | 77/0                         | 1             | JESD22-A110/A101 <sup>1</sup>               |
| Unbiased HAST  | 130°C/ 85% / 96 hours or equivalent  | 77/0                         | 3             | JESD22-A.118 <sup>1</sup>                   |
| Temperature Cycle  | -65°Cto +150°C non-biased 500 cycles or equivalent   | 77/0                         | 3             | JESD22-A104 <sup>1</sup>                    |
| Solderability  | Bake Preconditioning   | 22/0                         | 1             | ANSI/J-STD-002                              |
| Flammability   | Method A - UL 94V-0<br>or Method B - IEC standard 695- 2-2<br>or Method C - UL 1694              | 5/0                          | 1             | UL 94V-0<br>IEC standard 695-2-2<br>UL 1694 |
| Bond Shear   | Per wire size  | 5units x 30/0 bonds          | 3             | JESD22-B116                                 |
| Bond Pull Strength   | Per wire size  | 5units x 30/0 bonds          | 3             | ASTM F-459                                  |
| Die Shear  | Per die size   | 5/0                          | 3             | MIL-STD-883, TM 2019                        |
| High Temperature Storage   | 150 °C / 1000 hours  | 15/0                         | 3             | JESD22-A103 <sup>1</sup>                    |
| Moisture Sensitivity   | Surface Mount Only   | 12                           | 1             | J-STD-020 <sup>1</sup>                      |
| Radiation Response Characterization  | Per TI Datasheet   | 5units/dose level            | 1             | MIL-STD-883/Method 1019                     |

**Table 3-1. Space Enhanced Products New Device Qualification Matrix (continued)**

| Note that qualification by similarity ( <i>qualification family</i> ) per JEDEC JESD47 is allowed. |   |                              |               |             |
|--|---|------------------------------|---------------|-------------|
| DESCRIPTION  | CONDITION   | SAMPLE SIZE USED/<br>REJECTS | LOTS REQUIRED | TEST METHOD |
| Outgassing Characterization  | TML <=1% (Total Mass Lost) CVCM <=0.1%<br>(Collected Volatile Condensable Material) | 5                            | 1             | ASTM E595   |

1. Precondition performed per JEDEC Std. 22, Method A112 and A113.

## 4 Outgas Test Report

Outgassing test was performed on 5 units. A total mass loss (TML) of 1.00% and collected volatile condensable material (CVCM) of 0.10% were used as screening levels for rejection of spacecraft materials. The outgas test was performed in a vacuum environment of less than  $5 \times 10^{-5}$  Torr according to ASTM E 595, for a duration of 24 hours, at 125°C. The TML and CVCM were measured after the test.

**Table 4-1. Outgas Test Results**

| Device             | TML<br>< 1.0% | CVCM<br>< 0.1% |
|--------------------|---------------|----------------|
| SN54SC8T573MPWTSEP | Pass          | Pass           |

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