*Reliability Report*

# *TPS7H1210-SEP Production Flow and Reliability Report*


**ABSTRACT**

This report presents the reliability and qualification results for the TPS7H1210-SEP –16.5-V, 1-A, negative linear regulator in SEP (Space Enhanced Plastic). The TPS7H1210-SEP is manufactured with a controlled baseline and has the following:

- An Extended Product Life Cycle
- One Assembly and Test Site
- Product Traceability
- Extended Product-Change Notification


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## Trademarks

# 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 are certified to meet GEIA-STD-0002-1 Aerospace Qualified Electronic Components.

# 2 Space Enhanced Plastic Production Flow

## 2.1 Device Introduction

TPS7H1210-SEP is a radiation hardened device in a plastic package which allows this device to be used in space application. The device was verified immune to 43 MeV·cm$^2$/mg at 125°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 20 krad(Si) and each assembly and test lot follows the process flow shown in Figure 2-1. To ensure the quality of TPS7H1210-SEP, it is qualified with Space EP requirements. See Section 3 for further details.

## 2.2 TPS7H1210-SEP Space Enhanced Plastic Production Flow

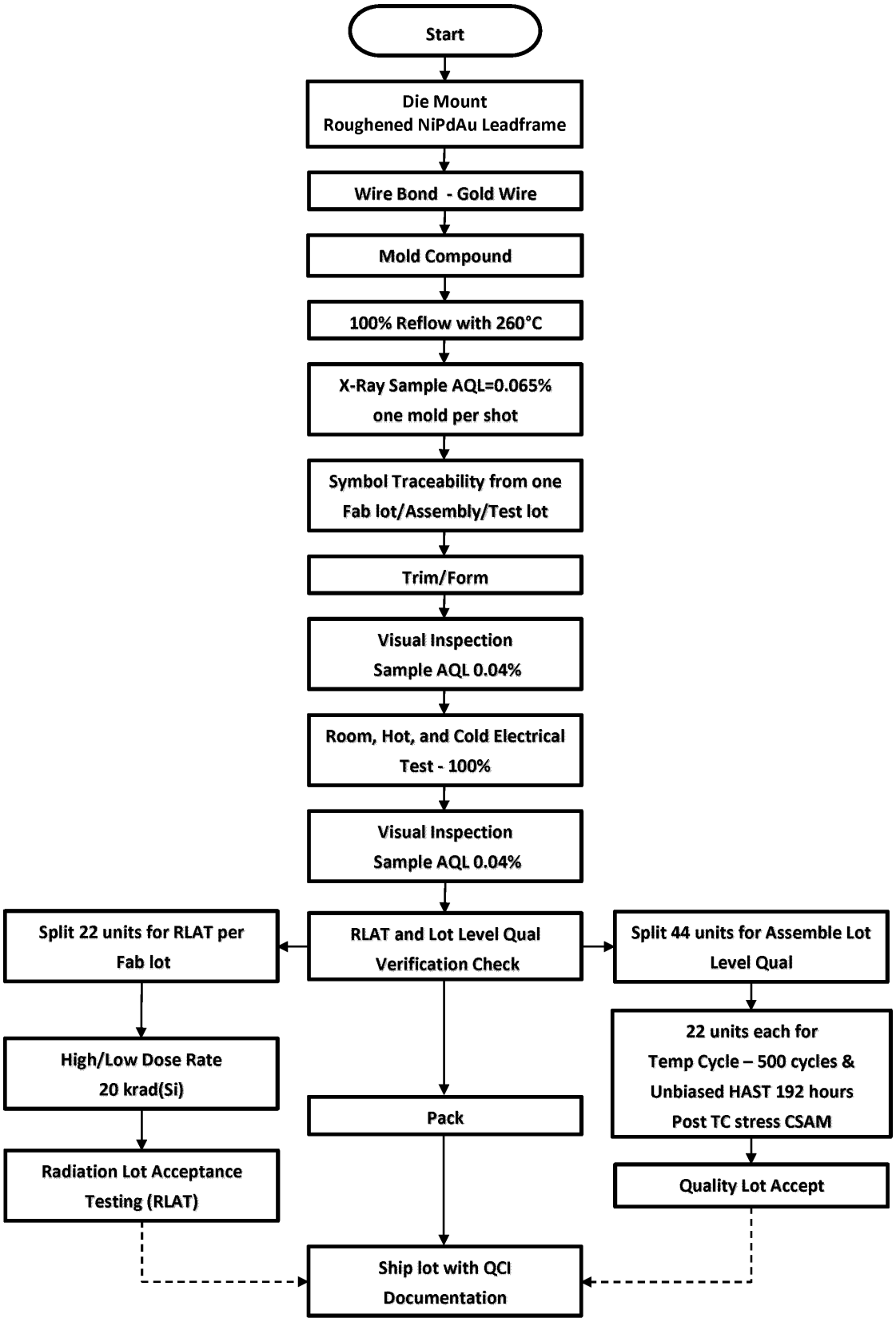


**Figure 2-1. TPS7H1210-SEP Space Enhanced Plastic Production Flow Chart**

# 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 device(s) through "Qualification by Similarity" (QBS) rules. By establishing similarity between the new device and those qualified previously, repetitive tests will be 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 in order for the QBS rules to apply. The attributes which are expected and allowed to vary will be 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 (“qualification family”) per JEDEC JESD47 is allowed. | | | | |
|---|---|---|---|---|
| **DESCRIPTION** | **CONDITION** | **SAMPLE SIZE USED/REJECTS** | **LOTS REQUIRED** | **TEST METHOD** |
| Electromigration | Maximum Recommended Operating Conditions | N/A | N/A | Per TI Design Rules |
| Wire Bond Life | Maximum Recommended Operating Conditions | N/A | N/A | Per TI Design Rules |
| Electrical Characterization | TI Data Sheet | 10 | 3 | N/A |
| Electrostatic Discharge Sensitivity | HBM | 3 units/voltage | 1 | EIA/JESD22-A114 |
| | CDM | | | EIA/JESD22-C101 |
| Latch-up | Per Technology | 6/0 | 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* |
| Biased HAST | 130°C / 85% / 96 hours | 77/0 | 3 | JESD22-A110* |
| Extended Biased HAST | 130°C / 85% / 250 hours (for reference) | 77/0 | 1 | JESD22-A110* |
| Unbiased HAST | 130°C / 85% / 96 hours | 77/0 | 3 | JESD22-A.118* |
| Temperature Cycle | -65°C to +150°C non-biased for 500 cycles | 77/0 | 3 | JESD22-A104* |
| Solder Heat | 260°C for 10 seconds | 22/0 | 1 | JESD22-B106 |
| Resistance to Solvents | Ink symbol only | 12/0 | 1 | JESD22-B107 |
| Solderability | Condition A (steam age for 8 hours) | 22/0 | 1 | ANSI/J-STD-002-92 |
| Flammability | Method A / Method B | 5/0 | 1 | UL-1964 |
| Bond Shear | Per wire size | 5 units x 30/0 bonds | 3 | JESD22-B116 |
| Bond Pull Strength | Per wire size | 5 units x 30/0 bonds | 3 | ASTM F-459 |
| Die Shear | Per die size | 5/0 | 3 | TM 2019 |
| High Temp Storage | 150 °C / 1,000 hours | 15/0 | 3 | JESD22-A103-A* |
| Moisture Sensitivity | Surface Mount Only | 12 | 1 | J-STD-020-A* |
| Radiation Response Characterization | Total Ionization Dose, Single-Event Latch-up | 5 units/dose level | 1 | MIL-STD-883/Method 1019 |
| Outgassing Characterization | TML (Total Mass Lost), CVCM (Collected Volatile Condensable material) | 5 | 1 | ASTM E595 |
| *Precondition performed per JEDEC Std. 22, Method A112/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 × 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**

| SAMPLE | TML<br>< 1.0% | CVCM<br>< 0.1% |
|---|---|---|
| TPS7H1210MRGWSEP | PASS | PASS |

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