# SN55HVD233-SEP Space EP Process Flow and Reliability Report

**ABSTRACT**

The SN55HVD233-SEP is used in applications employing the controller area network (CAN) serial communication physical layer in accordance with the ISO 11898 standard. As a CAN transceiver, the device provides, transmits, and receives capability between the differential CAN bus and a CAN controller, with signaling rates up to 1 Mbps. Designed for operation in especially harsh radiation environments, the SN55HVD233-SEP features crosswire, overvoltage, loss of ground protection to ±16 V, and overtemperature (thermal shutdown) protection.

The device operates over a wide –7-V to 12-V common mode range. This transceiver is the interface between the host CAN controller on the microprocessor, FPGA, or ASIC, and the differential CAN bus used in satellite applications. The SN55HVD233-SEP is packaged in a space enhanced plastic for low outgassing characteristics and is single event latch-up (SEL) immune up to 43 MeV-cm$^2$/mg, making the device suitable for low earth orbit space applications.

**Contents**

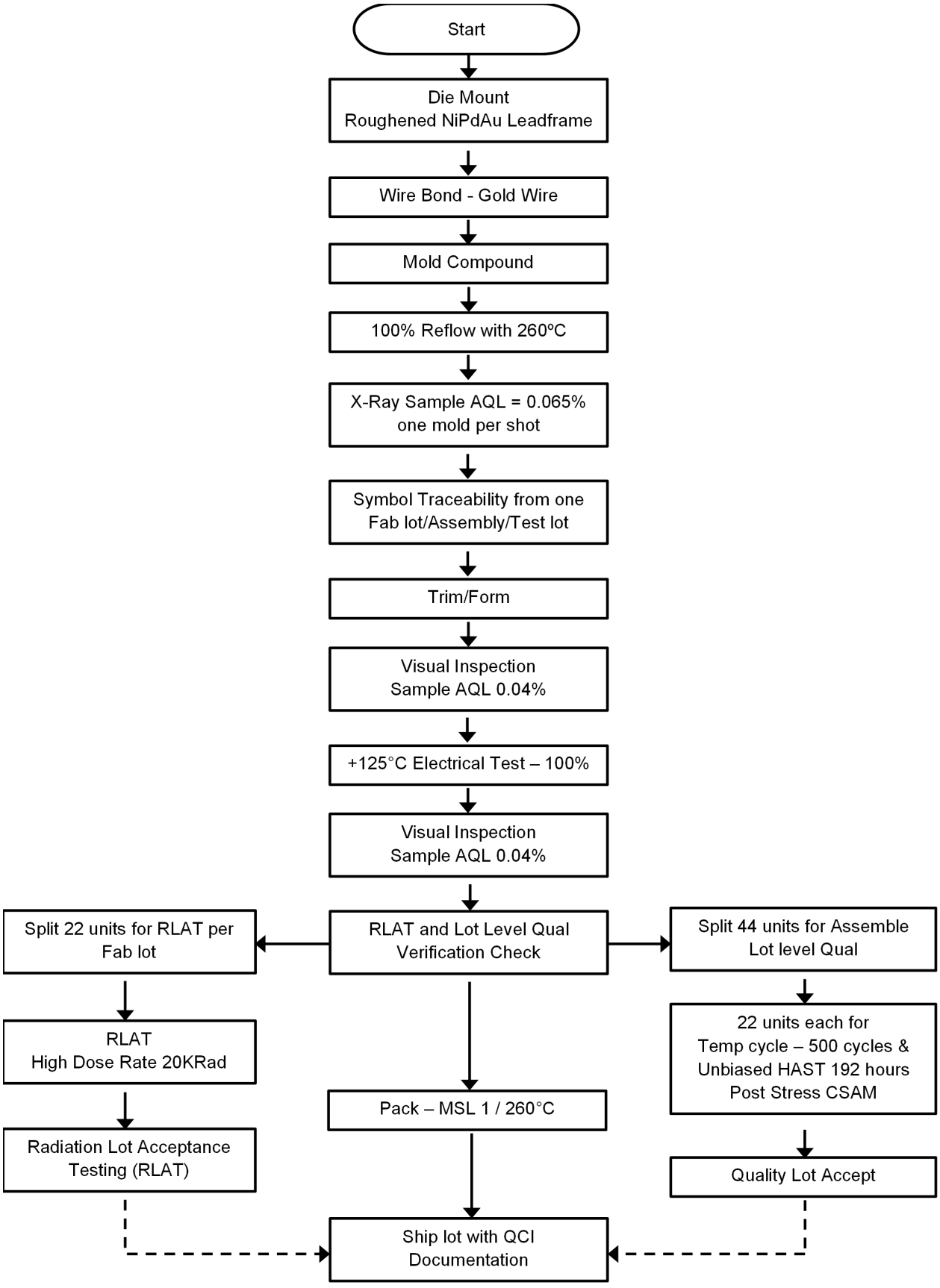


## Trademarks

# 1 Device Introduction

SN55HVD233-SEP is a Radiation Hardened device in plastic package which allow this device to be use in a space application. The device was verified immune to 43 MeV-cm$^2$/mg at 125°C for single event latchup. Each Fab 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 will go thru process flow as shown in Section 2. To ensure the quality of SN55HVD233-SEP, it is qualified with Space EP requirement which is explained in Section 3.

## 2 SN55HVD233-SEP Production Flow



# 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 1. SN55HVD233MDPSEP Device Baseline**

| **Device Baseline**[1] | | | | |
|---|---|---|---|---|
| TI Device: | SN55HVD233MDPSEP | | Assembly Site: | TI-FMX (Mexico) |
| DLA VID: | V62/18617-01XE | | Test Site: | TI-FMX (Mexico) |
| Wafer Fab: | DFAB | | Pin/Package Type: | SOIC (D) \| 8 |
| Fab Process: | LBC3S | | LeadFrame: | Cu |
| Fab Technology: | LBC3S | | Termination Finish: | NiPdAu |
| Die Revision: | D | | Bond Wire | 24.3um Au |
| Die Name: | BLBDHVD233VDC | | Moisture Sensitivity: | Level1-260°C |
| ESD CDM: | ±500V | | | |
| ESD HBM: | ±14000V | | | |

(1) Baseline information in effect as of the date of this report.

**Table 2. SN55HVD233MDTPSEP Device Baseline**

| **Device Baseline**[1] | | | | |
|---|---|---|---|---|
| TI Device: | SN55HVD233MDTPSEP | | Assembly Site: | TI-FMX (Mexico) |
| DLA VID: | V62/18617-01XE | | Test Site: | TI-FMX (Mexico) |
| Wafer Fab: | DFAB | | Pin/Package Type: | SOIC (D) \| 8 |
| Fab Process: | LBC3S | | LeadFrame: | Cu |
| Fab Technology: | LBC3S | | Termination Finish: | NiPdAu |
| Die Revision: | D | | Bond Wire | 24.3um Au |
| Die Name: | BLBDHVD233VDC | | Moisture Sensitivity: | Level1-260°C |
| ESD CDM: | ±500V | | | |
| ESD HBM: | ±14000V | | | |

(1) Baseline information in effect as of the date of this report.

## Table 3. Qualification Matrix

| 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(1) |
| Biased HAST | 130°C / 85% / 96 hours | 77/0 | 3 | JESD22-A110(1) |
| Extended Biased HAST | 130°C / 85% / 250 hours | 77/0 | 1 | JESD22-A110(1) |
| Unbiased HAST | 130°C / 85% / 96 hours | 77/0 | 3 | JESD22-A.118(1) |
| Temperature Cycle | –65°C to +150°C non-biased for 500 cycles | 77/0 | 3 | JESD22-A104(1) |
| 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(1) |
| Moisture Sensitivity | Surface Mount Only | 12 | 1 | J-STD-020-A(1) |
| Radiation Characterization | Total Ionization Dose and Single Event Latchup | 5 units/dose level | 1 | MIL-STD-883, TM1019 |
| Outgassing Characterization | TML (Total Mass Lost), CVCM (Collected Volatile Condensable material), WVR (Water vapor recorded) | 5 | 1 | ASTM E595 |

(1) 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 $5 \times 10^{-5}$ torr according to ASTM E 595, for a duration of 24 hours, at 125°C. The TML, CVCM, and the amount of Water Vapor Recovered (WVR) were measured after the test.

**RESULTS** : The following tables list the results of the testing:

Table 1: Outgas test results.

| Sample | TML (%) | CVCM (%) | WVR (%) |
|---|---|---|---|
| | <0.01 | <0.01 | 0.02 |

## Quality and Reliability Data Disclaimer

The attached quality and reliability information is specific to the TI Space Enhanced Plastic product family of plastic encapsulated commercial-off-the-shelf (COTS) semiconductor products and components. Due to possible differences in product assembly and test baselines, this information is NOT APPLICABLE to TI standard, industrial, or automotive catalog commercial products.

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