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.

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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.

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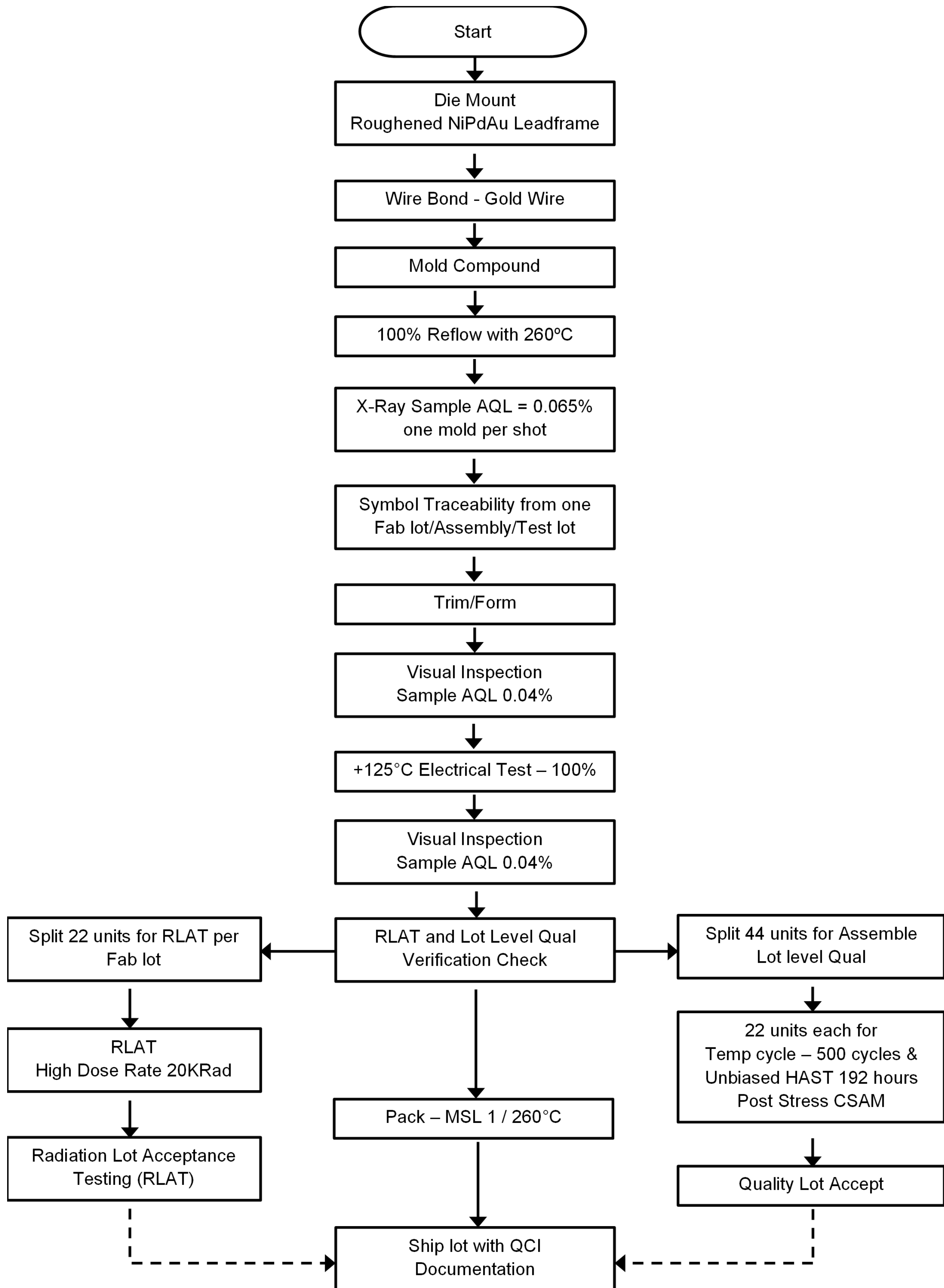
2 SN55HVD233-SEP Production Flow



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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.

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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.

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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, 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

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