Reliability Report

OPA4H199-SEP Production Flow and Reliability Report

ABSTRACT

This report presents the reliability and qualification results for the OPA4H199-SEP 40-V, radiation hardened, rail-to-rail input/output, low offset voltage, low noise op amp in space enhanced plastic. The OPA4H199-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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1 Trademarks

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2 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.

3 Device Introduction

OPA4H199-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 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 30 krad(Si) and each assembly and test lot follows the process flow shown in Figure 4-1 To ensure the quality of OPA4H199-SEP, it is qualified with Space EP requirements. See Section 5 for further details.

4 OPA4H199-SEP Space Enhanced Plastic Production Flow

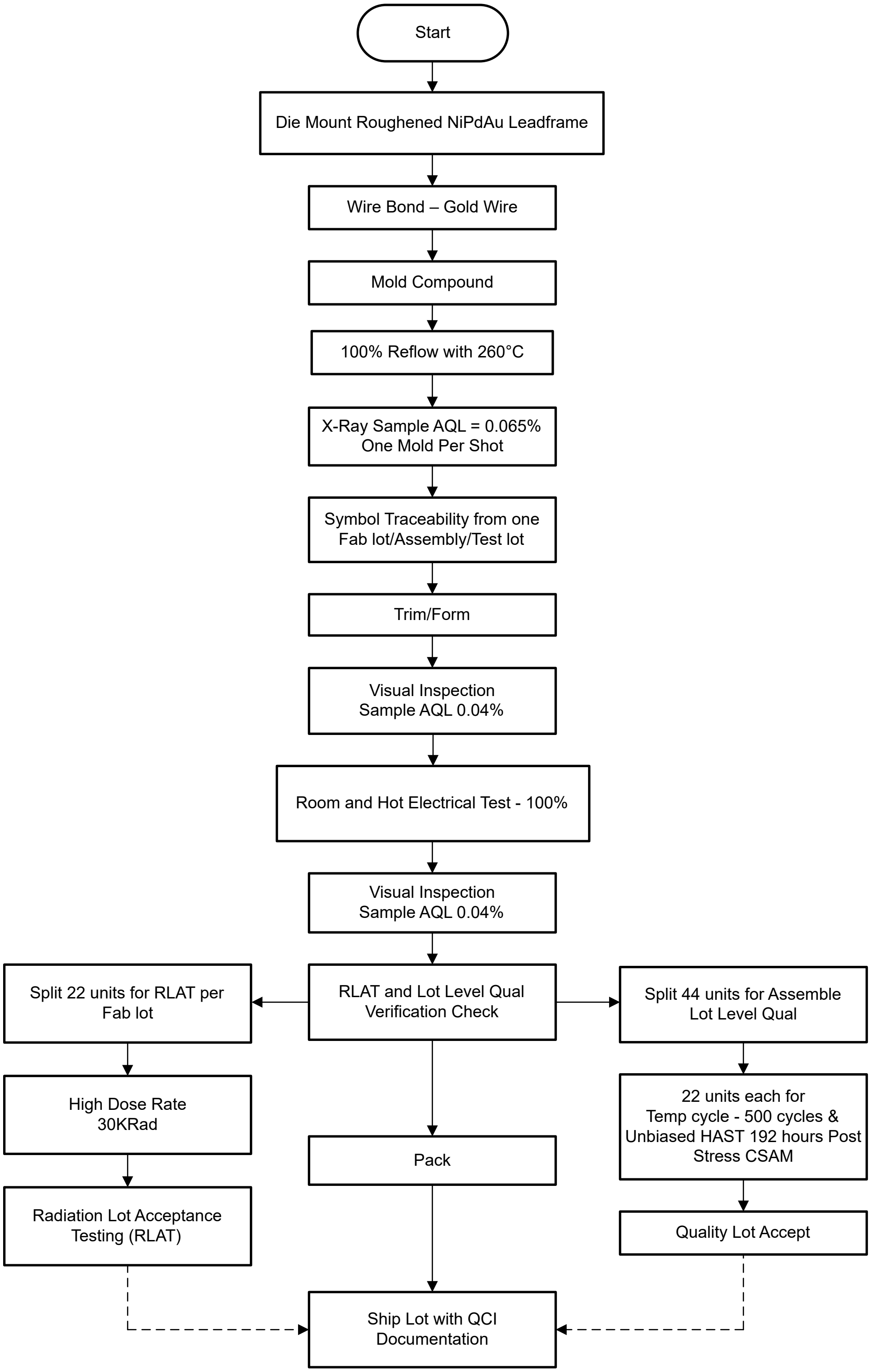

Figure 4-1. OPA4H199-SEP Space Enhanced Plastic Production Flow Chart

5 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 5-1. Device Baseline

TI Device:	**OPA4H199MDYYTSEP**		**Assembly Site:**	**TI PHI (Philippines)**
DLA VID:	V62/21615-02XE		Test Site:	TI PHI (Philippines)
Wafer Fab:	TI RFAB (USA)		Pin/Package Type:	14 / SOT-23-THN(DYY)
Fab Process:	LBC9		Leadframe:	Cu
Fab Technology:	Power BiCMOS		Termination Finish:	NiPdAu
Die Revision:	AA		Mount Compound:	Furukuwa AFN603-K13-50
Die Name:	G2OPA4991AAP		Bond Wire:	20.3 µm Au
ESD CDM:	±1000V		Mold Compound:	Sumitomo EME-G700L TD
ESD HBM:	±2000V		Moisture Sensitivity:	MSL 1 / 260°C
(1) Baseline information in effect as of the date of this report				

Table 5-2. 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	N/A	EIA/JESD22-A114
	CDM			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	45/0	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	5 units/dose level	1	MIL-STD-883/Method 1019
	Single-Event Latch-up			
Outgassing Characterization	TML (Total Mass Lost), CVCM (Collected Volatile Condensable material)	5	1	ASTM E595

*Precondition performed per JEDEC Std. 22, Method A112/A113.

6 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.

Table 6-1. Outgas Test Results

SAMPLE	TML (%)	CVCM (%)	WVR (%)
OPA4H199MDYYTSEP	0.07	0.01	0.06

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