Reliability Report

OPA4H838-SEP Enhanced Product Qualification and Reliability Report

Abstract

TI Device: OPA4H838-SEP

TI qualification testing is a risk mitigation process that is engineered to assure device longevity in customer applications. Wafer fabrication processes 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.

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1 Space Enhanced Plastic Production Flow

1.1 Device Introduction

OPA4H838-SEP is a radiation tolerant device in a plastic package which is qualified and screened for space applications. The device was verified immune to 43MeV × 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 30krad(Si) at 265krad(si)/s and each assembly and test lot follows the process flow shown in Figure 1-1. To maintain the quality of the OPA4H838-SEP, the device is qualified with Space EP requirements. See Section 2 for further details.

1.2 OPA4H838-SEP Space Enhanced Plastic Production Flow

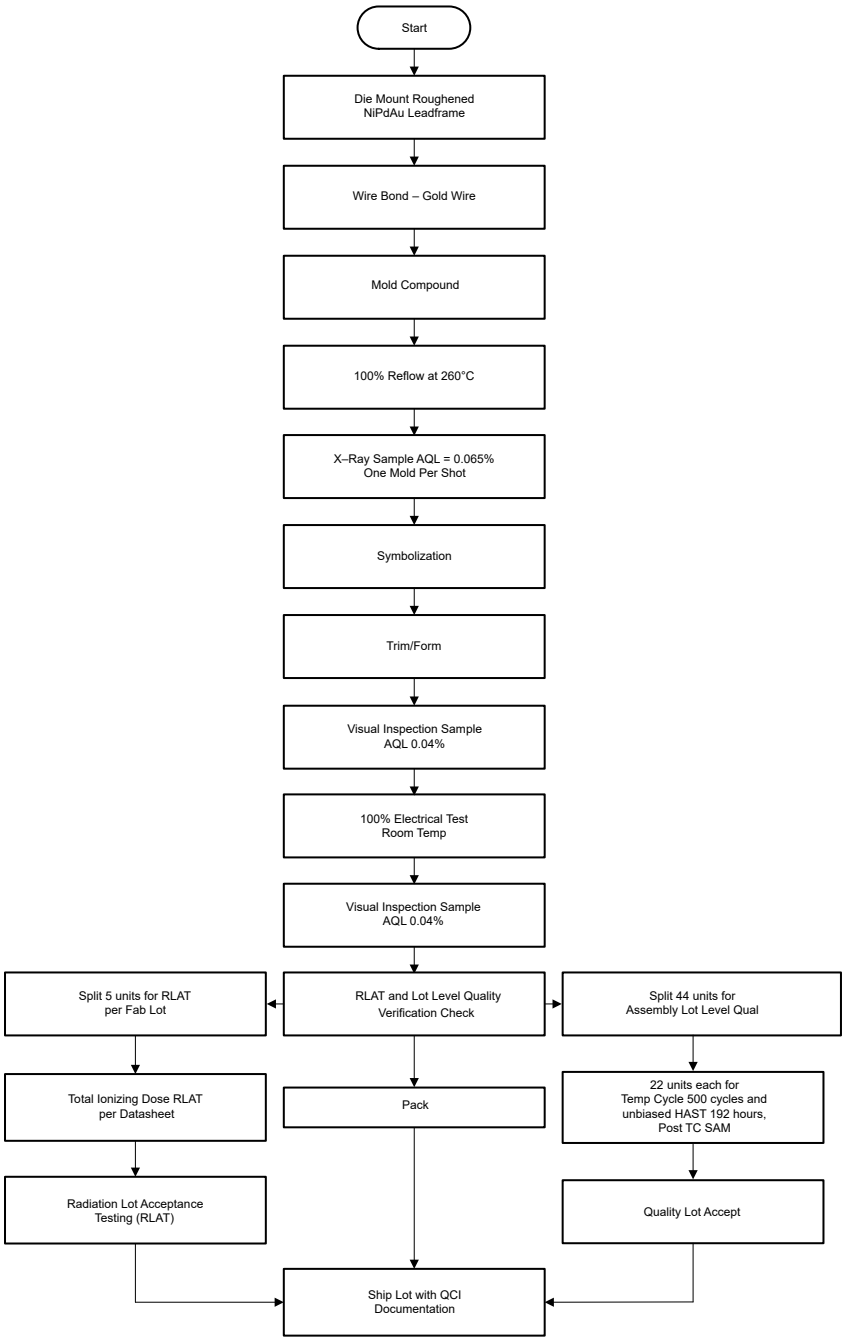


Figure 1-1. OPA4H838-SEP Space Enhanced Plastic Production Flow Chart

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2 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 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 is 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 is reviewed for conformance to the QBS rule sets applicable to that device. See JEDEC JESD47 for more information.

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Table 2-1. 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	-	N/A	N/A	Per TI Design Rules
Wire Bond Life	-	N/A	N/A	Per TI Design Rules
Electrical Characterization	TI Datasheet	30	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(4)
Physical Dimensions	TI Datasheet	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 or 110°C / 85% / 264 hours or 85°C / 85% / 1000 hours	77/0	3	JESD22-A110/A101 (1)
Extended Biased HAST(2)	130°C / 85% / 192 hours or 110°C / 85% / 528 hours or 85°C / 85% / 2000 hours	77/0	1	JESD22-A110/A101 (1)
Unbiased HAST	130°C / 85% / 96 hours or 110°C / 85% / 264 hours or 85°C / 85% / 1000 hours	77/0	3	JESD22-A.118(1)
Temperature Cycle	-65°C to +150°C non-biased for 500 cycles or equivalent	77/0	3	JESD22-A104(1)
Solderability	Bake Preconditioning	22/0	1	ANSI/J-STD-002
Flammability	Method A - UL 94V-0 or Method B - IEC standard 695- 2-2 or Method C - UL 1694	5/0	1	UL 94V-0 IEC standard 695-2-2 UL 1694
Bond Shear	Per wire size	5 units × 30/0 bonds	3	JESD22-B116
Bond Pull Strength	Per wire size	5 units × 30/0 bonds	3	ASTM F-459
Die Shear	Per die size	5/0	3	MIL-STD-883, TM 2019
High Temperature Storage	175°C / 420 hours or equivalent	15/0	3	JESD22-A103
Moisture Sensitivity	Surface Mount Only	12	1	J-STD-020
Radiation Response Characterization	Per TI Datasheet	–	1	Refer to Radiation Reports
Outgassing Characterization	TML ≤1% (Total Mass Lost) CVCM ≤0.1% (Collected Volatile Condensable Material)	–(3)	1	ASTM E595(3)

(1) Precondition performed per JEDEC Std. 22, Method A112/A113.
(2) For information only.
(3) Outgassing test was performed on representative 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.
(4) As indicated in the Absolute Maximum Ratings section of data sheet, “Currents on input signal pins exceeding absolute maximum rating can increase the risk of latch-up. External current-limiting protection is required.” Latch-up testing of the device at 125°C passed with 10mA current clamps on input signal pins. Latch-up testing of the device per JESD78 at 50°C passed without current clamps.

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Technology Family FIT / MTBF Data
Mean Time Between Fails (MTBF) and Failures in Time (FIT) rates are device reliability statistics calculated based on data collected from TI's internal reliability testing (life test). TI's DPPM/FIT/MTBF Estimator Search Tool reports the generic data based on technology groupings and shows conditions under which the rates were derived. All terms used in the tool and definitions can be found on the TI reliability terminology page. Failure rates are summarized by technology and mapped to the associated material part numbers. The failure rates are highly dependent on the number of units tested, therefore, it is not recommended to compare failure rates. TI DPPM/FIT/MTBF Estimator Search Tool webpage link: www.ti.com/quality/docs/estimator.tsp

Device Family Qualification Data
TI's Qualification Summary Search Tool reports generic qualification data representative of the material sets, processes, and manufacturing sites used by the device family and may not include all of the testing performed for a specific EP device. Please see the Enhanced Products New Device Qualification Matrix above for the full suite of qualification testing performed to release Enhanced Product devices. TI Qualification Summary Search webpage link: www.ti.com/qualificationsummary/qualsumm/home

Ongoing Reliability Monitoring
TI periodically monitors the reliability of its products, wafer fab processes, and package technologies, through its Ongoing Reliability Monitor (ORM) program. The ORM program involves collecting environmental reliability stress data on representative sets of devices, processes and packages. The results from the ORM program are updated quarterly in this report. TI Ongoing Reliability Monitoring Search webpage link: www.ti.com/orm/home?actionId=2801.html

For additional information or technical support please contact the Texas Instruments Customer Support Center.
For more information on TI Enhanced Products, click here.

5 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (May 2026) to Revision A (November 2026)	Page
• Updated Space Enhanced Plastic Production Flow Chart	2

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