Radiation Hardened Plastic Production and QCI Flow

This document outlines the production flow and lot assurance testing for the Renesas Radiation Hardened Plastic Products for space applications. In general, this applies to products with part numbers ISL71xxxSLHM and ISL71xxxSEHM. See the datasheet for each individual device for more information specific to each device.

Contents

1. Radiation Hardened Plastic Production Testing

This section outlines the production flow that 100% of the radiation hardened plastic products receive. This testing flow aligns with industry accepted standards including SAE AS6294/1 and NASA PEMS-INST-001.

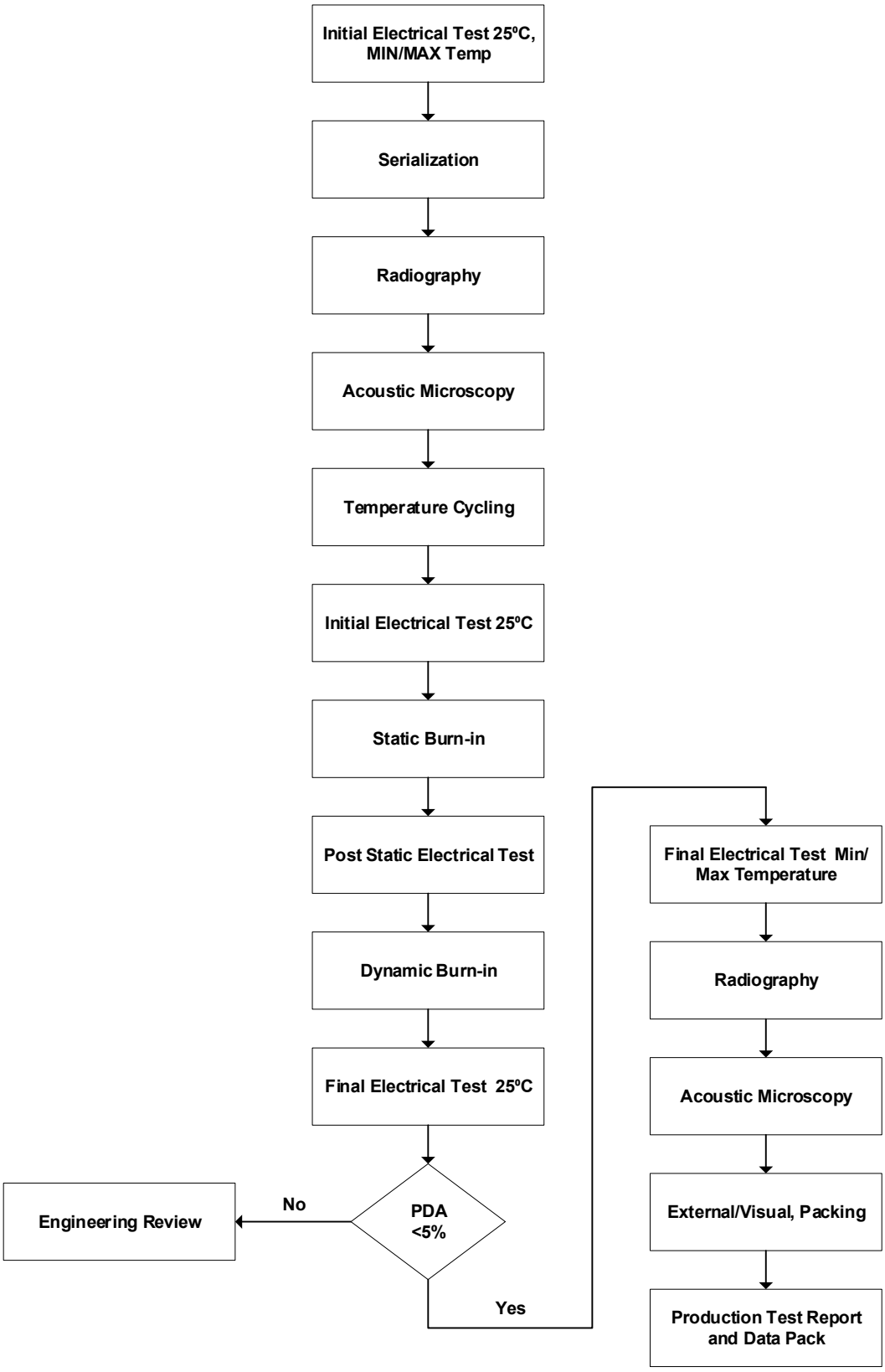

Figure 1. Flow Chart

Table 1. Radiation Hardened Plastic Production Test Flow Screening

Test	Test Method Used	Notes
Initial Electrical Test	Per device specification (Datasheet), Read and Record	Test performed at nominal operating temperature (25ºC), and the minimum and maximum rated temperatures
Laser Serialization	MIL-STD-1580 for PEMs	
Radiography	MIL-STD-1580 for PEMs	
Acoustic Microscopy	J-STD-020, J-STD-035	Includes 4hr post-Bake 125ºC
Temperature Cycling	MIL-STD-883, Method 1010	20 cycles, -65 to 150ºC
Electrical Test	Per device specification (Datasheet), Read and Record	Test performed at nominal operating temperature (25ºC)
Dynamic Burn-in	MIL-STD-883, Method 1015 for Class S	BI test performed at +135ºC
Post Dynamic Burn-in Electrical Test	Per device specification, Read and Record	Test performed at 25ºC
Static Burn-in test	MIL-STD-883, Method 1015 for Class S	BI test performed at +135ºC
Final Parametric and Functional Electrical Test	Per device specification, Read and Record	Test performed at nominal operating temperature (25ºC), and the minimum and maximum rated temperatures, delta analysis for PDA performed at 25ºC only
Calculate Percent Defective	Maximum Acceptable PDA, based on 25ºC delta analysis	<5%
Radiography	MIL-STD-1580 for PEMs	
Acoustic Microscopy	J-STD-020, J-STD-035	Includes 4hr post-Bake 125ºC
Select Samples for Lot Assurance Testing		See below for sample size selection criteria
Coplanarity Screening, External Visual, Packaging	MIL-STD-1580 for PEMs	

2. Radiation Hardened Plastic Lot Acceptance Testing

When units have gone through the production test flow outlined in the previous section, the products enter lot acceptance testing. These screenings are done on a lot-by-lot basis. For package related stresses, Subgroups 2 and 3 in the flowchart are intended to ensure that the package is reliably built and no defects exist. Subgroup 1 testing is intended to show any early life failures because of the die or wafer processing.

Lastly, radiation lot acceptance testing is performed per the device specification. The radiation test samples are not included in any of the subgroup testing and they are selected directly after completing the production flow.

2.1 Preconditioning

All samples selected for lot acceptance testing are exposed to a pre-conditioning step. Preconditioning consists of the following:

1. Precondition bake at 125°C +5°/-0°C for 4 hours minimum
2. Moisture Soak
   a. MSL 1 85°C, 85%RH 168 hours
   b. MSL 2 85°C, 60%RH 168 hours
   c. MSL 3 30°C, 60%RH 192 hours
3. SMT Device Reflow Simulation

2.2 Sampling Requirements

Lot Acceptance Test(s)	Samples Required Based on Lot Size				
Lot Size	**40–60**	**61–120**	**121–240**	**241–500**	**>500**
Total Samples Required (All samples go through Precondition Bake, Moisture Soak, SMT Reflow Simulation, and C-SAM)	36(0)	48(0)	69(0)	96(0)	135(0)
Subgroup 1 (Life test)	12(0)	16(0)	23(0)	32(0)	45(0)
Subgroup 2 (Biased HAST)	12(0)	16(0)	23(0)	32(0)	45(0)
Subgroup 3 (Temp Cycle)	12(0)	16(0)	23(0)	32(0)	45(0)
Radiation Testing	4(0)	4(0)	4(0)	4(0)	4(0)

2.3 Radiation Lot Assurance Testing

Samples for radiation lot assurance testing are selected from material that has undergone the production test flow. There are four samples per wafer lot tested. This testing qualifies the entire wafer lot for total ionizing dose radiation per the datasheet specification on a given part.

This section outlines the lot assurance testing that the radiation hardened plastic products receive with sampling requirements outlined in Sampling Requirements. This testing flow aligns with industry accepted standards including SAE AS6294/1 and NASA PEMS-INST-001

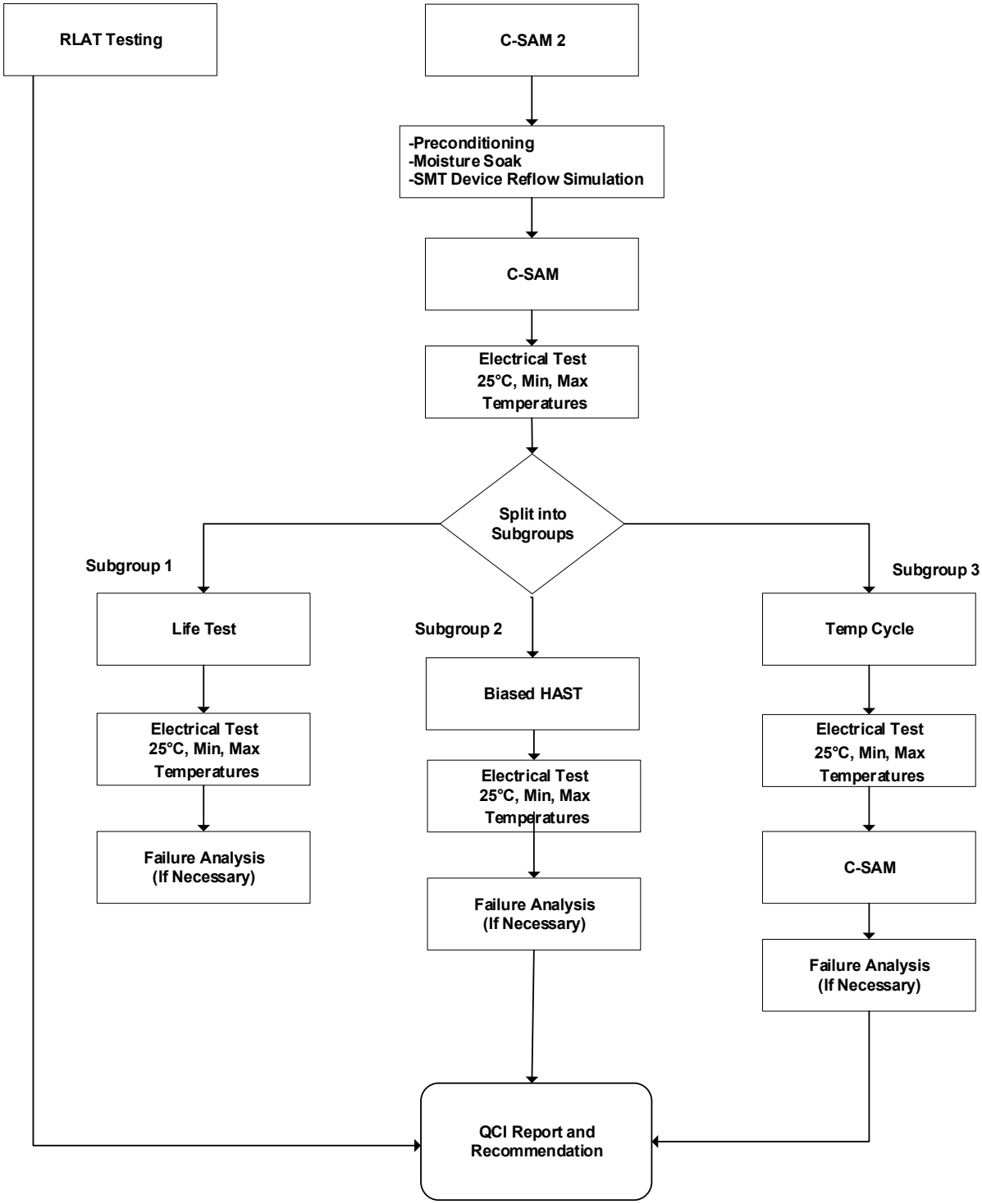

Figure 2. Flow Chart for Lot Acceptance Testing of Palm Bay PEMS Products

Table 2. Flow Table for Lot Acceptance Testing of Palm Bay PEMS Products

Test	Sub Test	Test Method and Conditions
Radiation Analysis		TID
External Visual Inspection		MIL-STD-1580 for PEMS
Preconditioning	Moisture Soak	JESD22-A113 paragraph 4.5 per applicable moisture sensitivity level (MSL) per J-STD-020
	SMT Devices Reflow Simulation (with flux application, cleaning, and drying)	JESD22-A113, paragraph 4.6 through 4.9. Peak solder reflow temperature +235°C
	Through-hole devices Resistance to soldering temperature	JESD22-B106
Acoustic Microscopy (C-SAM)	All parts	J-STD-020, J-STD-035 Includes 4hr post-Bake 125ºC
Electrical Measurements	Per device specification, Read and Record	Measure at 25°C, minimum and maximum rated temperatures
Life Test Subgroup 1	High Temperature Operational Life Testing (HTOL)	MIL-STD-883, Method 1005, Condition D T_A = 125°C, 2000hrs minimum or T_A = 135°C, 1600hrs minimum
	Electrical measurements (per device specification, Read and Record	Measure at 25C, minimum and maximum rated temperatures
Highly Accelerated Stress Test (HAST) Subgroup 2	Biased HAST	JESD22-A110 with continuous bias (96hrs, +130C, 85% RH).
	Electrical measurements (per device specification, Read and Record	Measure at 25C, minimum and maximum rated temperatures
Temperature Cycling Subgroup 3	Temperature Cycling	MIL-STD-883, Method 1010 Condition C, -65C to 150C, 500 cycles minimum
	Electrical measurements (per device specification, Read and Record	Measure at 25°C, minimum and maximum rated temperatures
	Acoustic Microscope inspection (C-SAM)	J-STD-020, J-STD-035

3. Revision History

Revision	Date	Description
1.1	Apr 12, 2021	Corrected two typos. Updated Figure 2
1.0	Apr 7, 2021	Initial release.

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