



## Environmental (IP-67) Test Report

Date: February 28, 2023

Report Number: R18857

Renesas Electronics America  
2605 Trade Centre Avenue, Ste C  
Longmont, CO 80503  
United States

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## ADMINISTRATIVE DATA

<b>Prepared For:</b>	Clayton Kostelecky Renesas Electronics America 2605 Trade Centre Avenue, Ste C Longmont, CO 80503 United States clayton.kostelecky.hx@renesas.com
<b>Tests Performed:</b>	Per Table 1 on page 5
<b>Test Facility:</b>	Element Materials Technology Denver 1530 Vista View Drive Longmont, CO 80504 720-340-7810
<b>Test Unit Description(s):</b>	Forty (40) Humidity Sensors
<b>Part Number(s):</b>	HS4011
<b>Serial Number(s):</b>	QXP101732-3
<b>Primary Test Specification(s):</b>	IEC 60529: 2013
<b>Purchase Order Number(s):</b>	262747
<b>Element Job Number:</b>	18857
<b>Element Quote Number(s):</b>	EPO018857Q
<b>Date of Receipt of Test Item(s):</b>	2/21/2023
<b>Project Begin Date:</b>	2/21/2023
<b>Project Completion Date:</b>	2/22/2023
<b>Test Report Completion Date:</b>	February 28, 2023

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## REVISIONS

Revision	Description	Date	Approval
N/A	Original Release	February 28, 2023	SS

## 1.0 Introduction

### 1.1 Scope

This document describes procedures and results of testing performed to the specification(s) and/or requirement(s) detailed herein. The results described in this report relate only to the specific items as received and tested.

### 1.2 Purpose

The purpose of this test was to demonstrate that the test samples met or exceeded the design specifications and/or requirements during or upon completion of exposure to the testing detailed herein.

### 1.3 Test Sequence

The following tests were performed:

**Table 1 – Test Sequence**

Test	Start Date	End Date
Dust (IP-6x)	2/21/2023	2/22/2023
Immersion (IP-x7)	2/22/2023	2/22/2023

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## 2.0 Applicable Documents

### 2.1 Specification

IEC 60529: 2013

## 3.0 General information

### 3.1 Test Equipment

All test instrumentation was calibrated in accordance with ANSI/NCSL Z540.1, Z540.3 or ISO 10012 as applicable, and are traceable to the National Institute of Standards and Technology (NIST) or other National Metrology Institute (NMI). Test equipment lists are available in individual test detail sections.

### 3.2 Test Conditions

Unless specified herein, all tests and measurements were performed at the room ambient conditions existing at the laboratory during testing:

Temperature: 15°C to 35°C

Relative Humidity: 0% to 80%

### 3.3 Test Witnessing/Monitoring

All testing was conducted by a qualified Element Technician and/or Test Engineer under the direction and cognizance of the Lab Manager and Quality Assurance. A Renesas Electronics America representative was on site.

### 3.4 Test Recording

Chronological logs of all significant events are maintained by test lab personnel and indicate date, times, and descriptions of conditions. These logs are used as reference and retained at Element and are available upon request.

### 3.5 Decision Rule

Based upon the type of testing being categorized as CAT I (Quantitative or Semi-Quantitative) as defined in A2LA's P103 Policy on Estimating Measurement Uncertainty for Testing Laboratories, decision rules are not required.

### 3.6 Disclaimer

Element Materials Technology is not held responsible for the testing and/or results obtained by the customer, identified on page(s): N/A

## 4.0 Dust (IP-6x) Test Details

### 4.1 Setup

- 4.1.1 Twenty (20) Humidity Sensors, as listed on page 3, were visually inspected with no signs of damage, deformation, discoloration, corrosion, or any other anomalies noted.
- 4.1.2 Due to the sample size, the testing was performed without an applied vacuum.
- 4.1.3 Test equipment utilized for testing as outlined in Table 2.

**Table 2 – Settling Dust (IP-6X) Equipment**

Test Dates: 2/21/2023 to 2/22/2023

ID#	Description	Mfr.	Model#	Serial#	Cal Date	Cal Due Date
FR661	Temp/Humidity Gauge	Control Company	Digi-Sense 90080-03	192232575	3/23/2022	3/23/2023
1224	Dust Chamber	Thermotron	D-27	29644	Reference Only	
FR071-1	Test Dust	Powder Technology Inc.	#399 Talc.	14222A	Factory Mix	
FR592	COUNTER SCALE 200lbs & Terminal	Mettler-Toledo	PBA 655- BC120 & ICS425	B714939435 & B74191832	10/04/2022	10/04/2023
FR613	Jumbo Stopwatch	Digi-Sense	-	181010713	3/28/2022	3/28/2023

### 4.2 Steps

- 4.2.1 The samples were set up in chamber 1224.
- 4.2.2 The samples were exposed to eight (8) hours in the dust environment.
- 4.2.3 Following exposure, the samples were brushed off and removed from the chamber.
- 4.2.4 Upon test completion, at ambient conditions, the samples were visually inspected, and then remained onsite for further testing.

### 4.3 Results

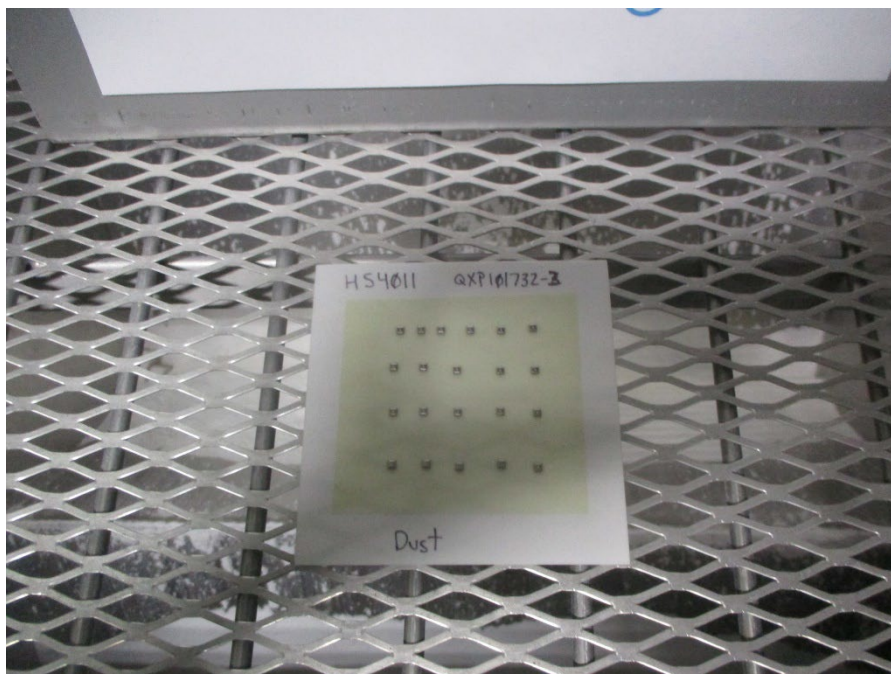
- 4.3.1 Per IEC 60529: 2013, the protection is satisfactory if no deposit of dust is observable inside the enclosure at the end of the test.
- 4.3.2 No signs of dust ingress was observed within the samples.  
Per IEC 60529: 2013, the samples completed testing with a satisfactory result.

## 4.0 Settling Dust (IP-6X) Test Details (Continued)

### 4.4 Photographs



**Photo 1 – Samples setup**



**Photo 2 – Samples setup**

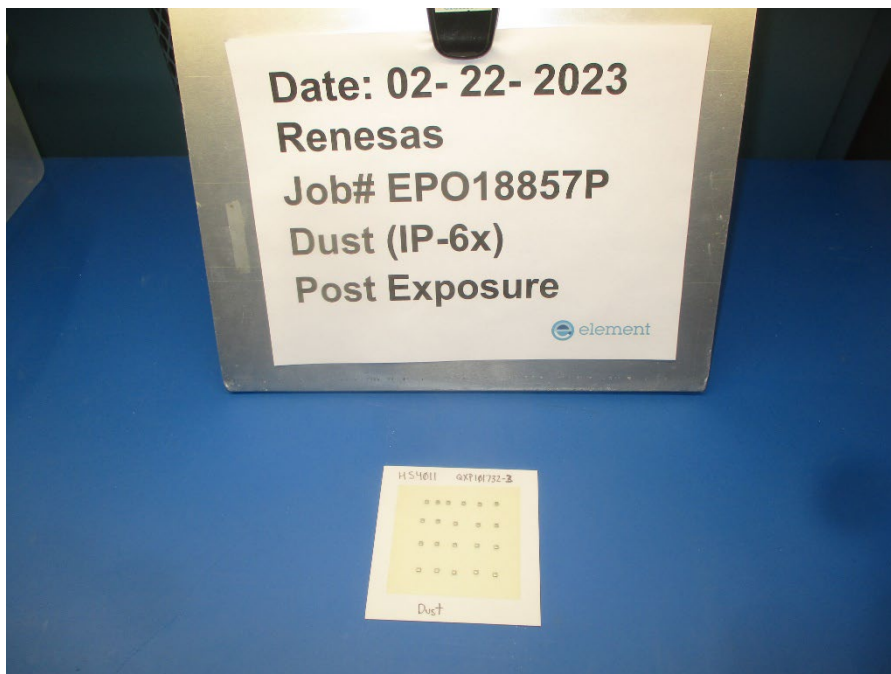


## 4.0 Settling Dust (IP-6X) Test Details (Continued)

### 4.4 Photographs (Continued)



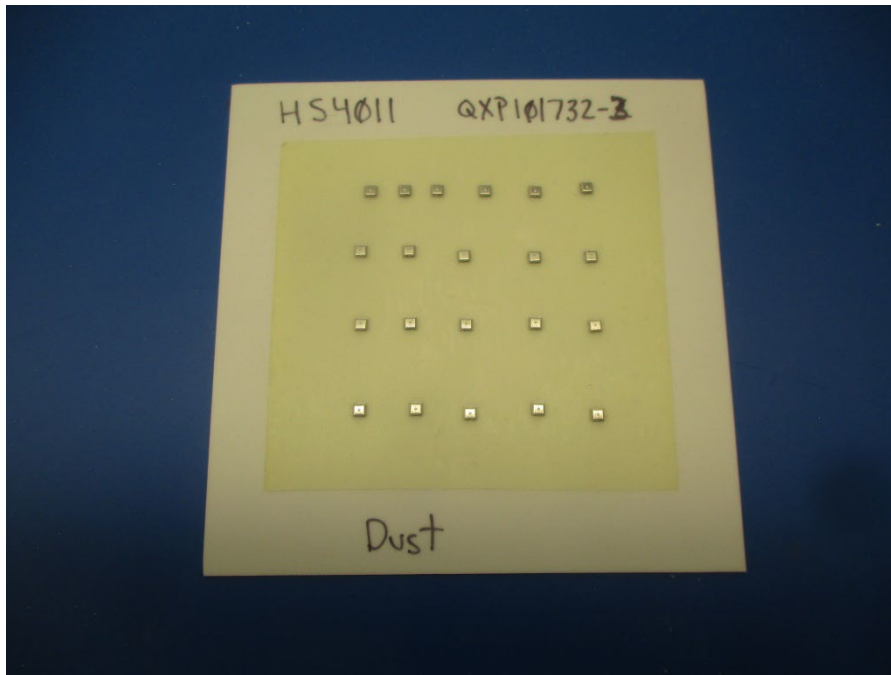
**Photo 3 – Samples post exposure**



**Photo 4 – Samples post exposure**

## 4.0 Settling Dust (IP-6X) Test Details (Continued)

### 4.4 Photographs (Continued)



**Photo 5** – *Samples post exposure*



**Photo 6** – *Samples post exposure*

## 5.0 Immersion (IP-x7) Test Details

### 5.1 Setup

- 5.1.1 Twenty (20) Humidity Sensors, as listed on page 3, were visually inspected with no signs of damage, deformation, discoloration, corrosion, or any other anomalies noted.
- 5.1.2 Test equipment utilized for testing as outlined in Table 3.

**Table 3 – Immersion (IP-x7) Equipment**

Test Dates: 2/22/2023 to 2/22/2023

ID#	Description	Mfr.	Model#	Serial#	Cal Date	Cal Due Date
FR661	Temp/Humidity Gauge	Control Company	Digi-Sense 90080-03	192232575	3/23/2022	3/23/2023
1236	SM-32C CHAMBER	THERMOTRON	SM-32C	26154	12/08/2022	12/08/2023
FR467	Temperature Reader	Partlow-west Corp	51100011	1625377-0001	1/10/2023	1/10/2024
FR066	Tape Measure	Stanley	Fat Max Blade Armor	1	6/20/2022	6/19/2024
FR613	Jumbo Stopwatch	Digi-Sense	-	181010713	3/28/2022	3/28/2023

### 5.2 Steps

- 5.2.1 The samples were placed into the chamber to condition it to be within 5°K of the water temperature.
- 5.2.2 The samples were secured to a weight and placed into mesh bag for testing.
- 5.2.3 The immersion depth was set at 1 meter.
- 5.2.4 The samples were lowered into the tank and maintained at this 1-meter depth for 30 minutes.
- 5.2.5 The samples were removed and blotted dry with a towel.
- 5.2.6 Upon test completion, at ambient conditions, the samples were visually inspected, and then returned to customer for final analysis.

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## 5.0 Immersion (IP-x7) Test Details (Continued)

### 5.3 Results

- 5.3.1 Per IEC 60529 the passing criteria if any water has entered, it will not:
- 5.3.1.1 Be sufficient to interfere with the correct operation of the equipment or impair safety.
  - 5.3.1.2 Deposit on insulation parts where it could lead to tracking along the creepage distances.
  - 5.3.1.3 Reach live parts or windings not designed to operate when wet.
  - 5.3.1.4 Accumulate near the cable end or enter the cable if any.
- 5.3.2 No signs of water ingress were found.  
Per IEC 60529: 2013, the samples completed testing with a satisfactory result.

## 5.0 Immersion (IP-x7) Test Details (Continued)

### 5.4 Photographs



**Photo 7 – Test set up - Conditioning**



**Photo 8 – Samples setup**



## 5.0 Immersion (IP-x7) Test Details (Continued)

### 5.4 Photographs (Continued)



**Photo 9 – Test set up**



**Photo 10 – Depth verification 1 meter**

## 5.0 Immersion (IP-x7) Test Details (Continued)

### 5.4 Photographs (Continued)



**Photo 11 – Samples setup**



**Photo 12 – Samples post exposure**

## 5.0 Immersion (IP-x7) Test Details (Continued)

### 5.4 Photographs (Continued)

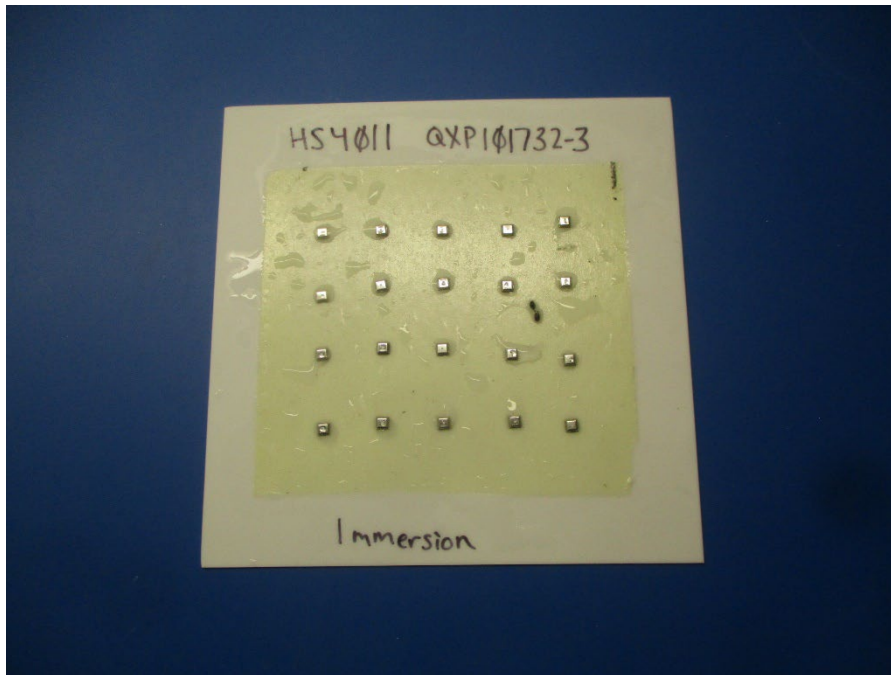


Photo 13 – Samples post exposure

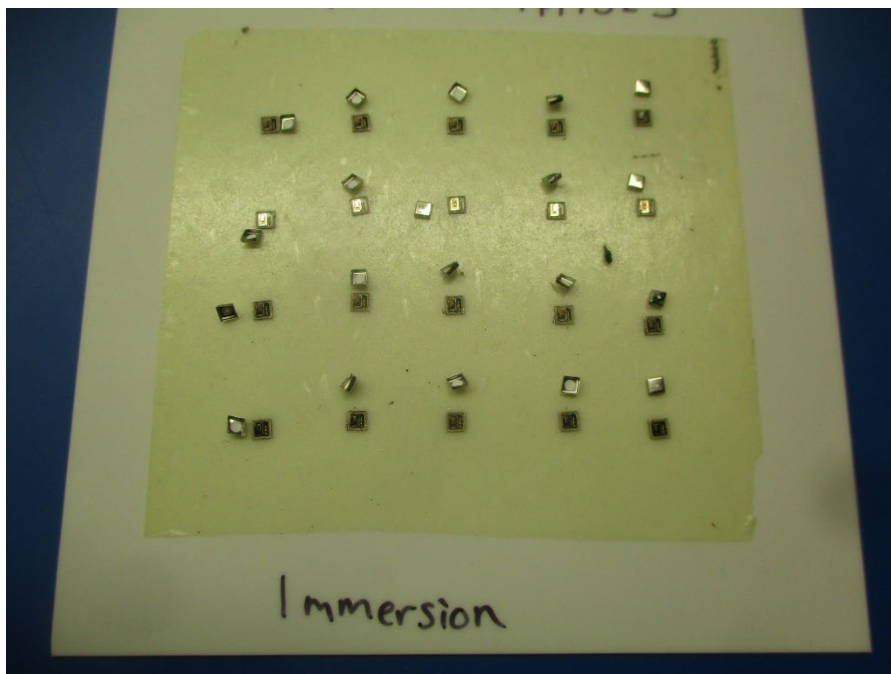


Photo 14 – Samples post exposure



## 5.0 Immersion (IP-x7) Test Details (Continued)

### 5.5 Plots, charts, graphs, etc.

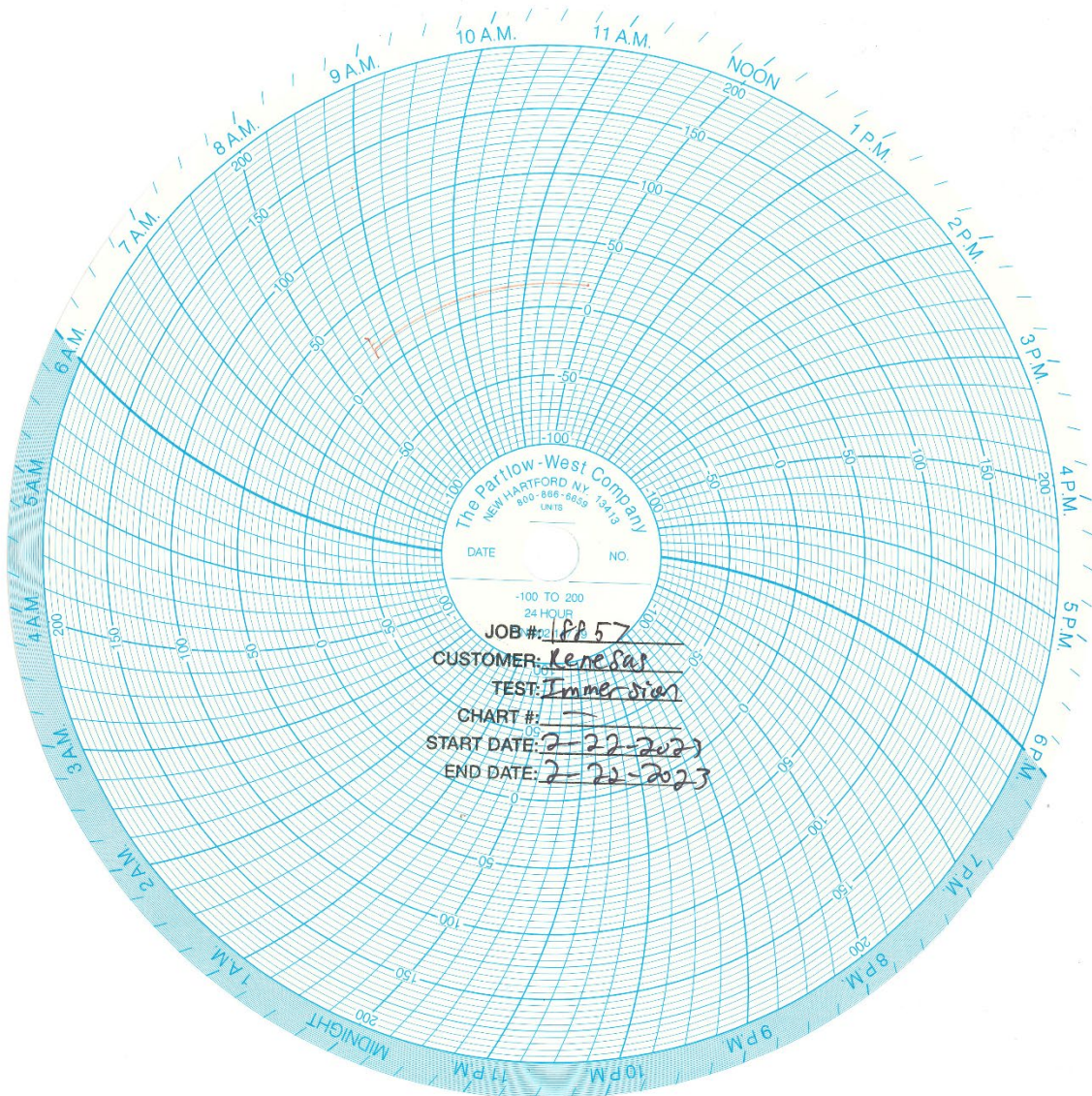


Figure 1 – Immersion Chart

**End of Report.**