

CERTIFICATE OF ACCREDITATION

QRT Inc.

Accreditation No. : KT218

Corporation Registration No. : 134411-0059857

Address of Laboratory : (Branch site)2091, Gyeongchung-daero, Bubal-eup, Icheon-si,
Gyeonggi-do, Republic of Korea

(Branch site-1)215, Daesinro Heungdeokgu Cheongjusi
Chungcheongbuk-do, Republic of Korea

(Branch site-2)109, Gwanggyo-ro, Yeongtong-gu, Suwon-si, Gyeonggi-
do, Republic of Korea

Date of Initial Accreditation : April 19, 2004

Validity of Accreditation : July 02, 2024 ~ July 01, 2028

Scope of Accreditation : Attached Annex

Date of issue : July 02, 2024

This testing laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to Joint ISO-ILAC-IAF Communiqué).



CHIN CHONGWOOK

Head

Korea Laboratory Accreditation Scheme

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03. Electrical Testing

03.014 Environmental and Reliability

Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
AEC-Q100-002- REV-E:2013	Electrical materials and components	HUMAN BODY MODEL (HBM) ELECTROSTATIC DISCHARGE TEST	Voltage : (50 ~ 8 000) V	BS-2	N
AEC-Q100-004- REV-D:2012	Electrical materials and components	IC LATCH-UP TEST (Exception) 5. Failure criteria	Current : Max 2 A Voltage : Max 100 V	BS-2	N
AEC-Q100-005- REV-D1:2012	Electrical materials and components	NON-VOLATILE MEMORY PROGRAM/ERASE ENDURANCE, DATA RETENTION, AND OPERATIONAL LIFE TEST (Exception) 3.6 Measurements 4 Failure criteria	Temperature : (55 ~ 150) °C	BS	N
AEC-Q100-005- REV-D1:2012	Electrical materials and components	NON-VOLATILE MEMORY PROGRAM/ERASE ENDURANCE, DATA RETENTION, AND OPERATIONAL LIFE TEST (Exception) 3.6 Measurements 4 Failure criteria	Temperature : (55 ~ 150) °C	BS-1	N
AEC-Q100-008- REV-A:2003	Electrical materials and components	EARLY LIFE FAILURE RATE (ELFR) (Exception) 3.3 Acceptance Criteria 3.4 Sample Disposition	Temperature : (55 ~ 150) °C	BS	N
AEC-Q100-008- REV-A:2003	Electrical materials and components	EARLY LIFE FAILURE RATE (ELFR) (Exception) 3.3 Acceptance Criteria 3.4 Sample Disposition	Temperature : (55 ~ 150) °C	BS-1	N
AEC-Q100-011- REV-D:2019	Electrical materials and components	CHARGED DEVICE MODEL (CDM) ELECTROSTATIC DISCHARGE TEST (Exception) 3.2.3 Relay Discharge Method 3.4 Measurements 4 Failure criteria	Voltage : (50 ~ 2 000) V	BS-2	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
AEC-Q101-001- REV-A:2005	Electrical materials and components	HUMAN BODY MODEL (HBM) ELECTROSTATIC DISCHARGE(ESD) TEST (Exception) 3.4 Measurements 4 Failure criteria	Voltage : (50 ~ 8 000) V	BS-2	N
AEC-Q101-005- REV-A:2019	Electrical materials and components	CHARGED DEVICE MODEL (CDM) ELECTROSTATIC DISCHARGE(ESD) TEST (Exception) 3.4 Measurements 4 Failure criteria	Voltage : (50 ~ 2 000) V	BS-2	N
ANSI/ESDA/JEDEC JS-002-2018	Electrical materials and components	FOR ELECTROSTATIC DISCHARGE SENSITIVITY TESTING CHARGE DEVICE MODEL (CDM) - DEVICE LEVEL (Exception) 7.7.2 Device Test 7.2.2.1 Pre-Stress Testing 7.2.2.2 Failure criteria	Voltage : (50 ~ 2 000) V	BS-2	N
ANSI/ESDA/JEDEC S-001-2017	Electrical materials and components	FOR ELECTROSTATIC DISCHARGE (ESD) SENSITIVITY TESTING HUMAN BODY MODEL (HBM) - COMPONENT LEVEL (Exception) 6.1 Parametric and Functional Testing 6.7 Testing After Stressing 7.0 Failure criteria	Voltage : (50 ~ 8 000) V	BS-2	N
IPC/JEDEC J-STD- 020F:2022	Electrical materials and components	MOISTURE/REFLOW SENSITIVITY CLASSIFICATION FOR NONHERMETIC SURFACE MOUNT DEVICES (Exception) 3.6 Electrical test 5.2 Initial electrical test 5.8 Final electrical test	Bake Temperature : 125 °C Moisture Soak Temperature: (30 ~ 85) °C Humidity : (60 ~ 85) % R.H Reflow Peak Temperature : Max. 260 °C	BS	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
IPC/JEDEC J-STD-020F:2022	Electrical materials and components	MOISTURE/REFLOW SENSITIVITY CLASSIFICATION FOR NONHERMETIC SURFACE MOUNT DEVICES (Exception) 3.6 Electrical test 5.2 Initial electrical test 5.8 Final electrical test	Bake Temperature : 125 °C Moisture Soak Temperature: (30 ~ 85) °C Humidity : (60 ~ 85) % R.H Reflow Peak Temperature : Max. 260 °C	BS-1	N
JESD22-A101D.01:2021	Electrical materials and components	STEADY STATE TEMPERATURE HUMIDITY BIAS LIFE TEST (Exception) 5 Failure criteria	Temperature : 85 °C Humidity : 85 % R.H.	BS	N
JESD22-A101D.01:2021	Electrical materials and components	STEADY STATE TEMPERATURE HUMIDITY BIAS LIFE TEST (Exception) 5 Failure criteria	Temperature : 85 °C Humidity : 85 % R.H.	BS-1	N
JESD22-A102E:2015	Electrical materials and components	ACCELERATED MOISTURE RESISTANCE UNBIASED AUTOCLAVE (Exception) 5 Failure criteria	Temperature :121 °C Humidity :100 % R.H. vapor Pressure :205 kPa	BS	N
JESD22-A102E:2015	Electrical materials and components	ACCELERATED MOISTURE RESISTANCE UNBIASED AUTOCLAVE (Exception) 5 Failure criteria	Temperature :121 °C Humidity :100 % R.H. vapor Pressure :205 kPa	BS-1	N
JESD22-A103E.01:2021	Electrical materials and components	HIGH TEMPERATURE STORAGE LIFE (Exception) 4.2 Measurements 4.3 Failure criteria	Temperature : (125 ~ 300) °C	BS	N
JESD22-A103E.01:2021	Electrical materials and components	HIGH TEMPERATURE STORAGE LIFE (Exception) 4.2 Measurements 4.3 Failure criteria	Temperature : (125 ~ 300) °C	BS-1	N
JESD22-A104F.01:2023	Electrical materials and components	TEMPERATURE CYCLING (Exception) 5.9 Measurements 6 Failure criteria	Temperature : (-65 ~ 150) °C	BS	N
JESD22-A104F.01:2023	Electrical materials and components	TEMPERATURE CYCLING (Exception) 5.9 Measurements 6 Failure criteria	Temperature : (-65 ~ 150) °C	BS-1	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
JESD22-A105D:2020	Electrical materials and components	POWER AND TEMPERATURE CYCLING (Exception) 4.4 Measurements 5 Failure criteria	Temperature : (-40 ~ 125) °C	BS-1	N
JESD22-A105D:2020	Electrical materials and components	POWER AND TEMPERATURE CYCLING (Exception) 4.4 Measurements 5 Failure criteria	Temperature : (-40 ~ 125) °C	BS	N
JESD22-A106B.02:2022	Electrical materials and components	THERMAL SHOCK (Exception) 4.2 Measurements 4.3 Failure criteria	Temperature : (-65 ~ 150) °C	BS	N
JESD22-A108G:2022	Electrical materials and components	TEMPERATURE, BIAS, AND OPERATING LIFE (Exception) 6 Measurements 7 Failure criteria	Temperature : (-40 ~ 200) °C	BS	N
JESD22-A108G:2022	Electrical materials and components	TEMPERATURE, BIAS, AND OPERATING LIFE (Exception) 6 Measurements 7 Failure criteria	Temperature : (-40 ~ 200) °C	BS-1	N
JESD22-A110E.01:2021	Electrical materials and components	HIGHLY ACCELERATED TEMPERATURE AND HUMIDITY STRESS TEST (HAST) (Exception) 5 Failure criteria	Temperature: (110 ~ 130) °C Humidity : 85 % R.H. Vapor Pressure : (122 ~ 230) kPa	BS	N
JESD22-A110E.01:2021	Electrical materials and components	HIGHLY ACCELERATED TEMPERATURE AND HUMIDITY STRESS TEST (HAST) (Exception) 5 Failure criteria	Temperature: (110 ~ 130) °C Humidity : 85 % R.H. Vapor Pressure : (122 ~ 230) kPa	BS-1	N
JESD22-A113I:2020	Electrical materials and components	PRECONDITIONING OF NONHERMETIC SURFACE MOUNT DEVICES PRIOR TO RELIABILITY TESTING (Exception) 4.1 Initial electrical test 4.10 Final electrical test	Temperature Cycling Temperature : (-40 ~ 150) °C Bake out Temperature : 125 °C Moisture Soak Temperature: (30 ~ 85) °C Humidity: (60 ~ 85) % R.H Reflow Peak Temperature.: Max. 260 °C	BS-1	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
JESD22- A113I:2020	Electrical materials and components	PRECONDITIONING OF NONHERMETIC SURFACE MOUNT DEVICES PRIOR TO RELIABILITY TESTING (Exception) 4.1 Initial electrical test 4.10 Final electrical test	Temperature Cycling Temperature : (-40 ~ 150) °C Bake out Temperature : 125 °C Moisture Soak Temperature: (30 ~ 85) °C Humidity: (60 ~ 85) % R.H Reflow Peak Temperature.: Max. 260 °C	BS	N
JESD22- A115C:2010	Electrical materials and components	ELECTROSTATIC DISCHARGE (ESD) SENSITIVITY TESTING MACHINE MODEL (MM) (Exception) 5 Failure criteria	Voltage : (50 ~ 1 500) V	BS-2	N
JESD22- A117E:2018	Electrical materials and components	ELECTRICALLY ERASABLE PROGRAMMABLE ROM (EEPROM) PROGRAM/ERASE ENDURANCE AND DATA RETENTION STRESS TEST (Exception) 4.1.3 Electrical test verification 4.4 Measurements 5 Failure criteria and calculation	Temperature : (55 ~ 150) °C	BS-1	N
JESD22- A117E:2018	Electrical materials and components	ELECTRICALLY ERASABLE PROGRAMMABLE ROM (EEPROM) PROGRAM/ERASE ENDURANCE AND DATA RETENTION STRESS TEST (Exception) 4.1.3 Electrical test verification 4.4 Measurements 5 Failure criteria and calculation	Temperature : (55 ~ 150) °C	BS	N
JESD22- A118B.01:2021	Electrical materials and components	ACCELERATED MOISTURE RESISTANCE - UNBIASED HAST (Exception) 5 Failure criteria	Temperature: (110 ~ 130) °C Humidity : 85 % R.H. Vapor Pressure : (122 ~ 230) kPa	BS-1	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
JESD22-A118B.01:2021	Electrical materials and components	ACCELERATED MOISTURE RESISTANCE - UNBIASED HAST (Exception) 5 Failure criteria	Temperature: (110 ~ 130) °C Humidity : 85 % R.H. Vapor Pressure : (122 ~ 230) kPa	BS	N
JESD22-A119A:2015	Electrical materials and components	LOW TEMPERATURE STORAGE LIFE (Exception) 3.2 Measurements 3.3 Failure criteria	Temperature : (-40 ~ -65) °C	BS-1	N
JESD22-A119A:2015	Electrical materials and components	LOW TEMPERATURE STORAGE LIFE (Exception) 3.2 Measurements 3.3 Failure criteria	Temperature : (-40 ~ -65) °C	BS	N
JESD22-B101D:2022	Electrical materials and components	EXTERNAL VISUAL (Exception) 6 Failure criteria	Magnification : Max. 100 X	BS-1	N
JESD22-B101D:2022	Electrical materials and components	EXTERNAL VISUAL (Exception) 6 Failure criteria	Magnification : Max. 100 X	BS	N
JESD22-B103B.01:2016	Electrical materials and components	VIBRATION, VARIABLE FREQUENCY (Exception) 4.3 Optional stress application - Random vibration test (cont'd) Table 2 - Overall measures of random vibration test levels ; Service condition A, B 4.4 Measurements 5 Failure Criteria	Frequency : (10 ~ 2 000) Hz Acceleration : (10 ~ 500) m/s ²	BS	N
JESD22-B110B.01:2019	Electrical materials and components	MECHANICAL SHOCK - DEVICE AND SUBASSEMBLY (Exception) 4.3 Measurements 5 Failure criteria	Acceleration Peak: (1 000 ~ 29 000) m/s ²	BS	N
JESD22-B113B:2018	Electrical materials and components	BOARD LEVEL CYCLIC BEND TEST METHOD FOR INTERCONNECT RELIABILITY CHARACTERIZATION OF SMT ICS FOR HANDHELD ELECTRONIC PRODUCT (Exception) 10 Electrical monitoring requirements and failure criteria	Frequency : (1 ~ 3) Hz Depth : (2 ~ 4) mm	BS	N

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JESD22- C101F:2013	Electrical materials and components	FIELD-INDUCED CHARGED-DEVICE MODEL TEST METHOD FOR ELECTROSTATIC DISCHARGE WITHSTAND THRESHOLDS OF MICRO ELECTRONIC COMPONENTS (Exception) 11 Failure criteria	Voltage : (50 ~ 2 000) V	BS-2	N
JESD74A:2007	Electrical materials and components	EARLY LIFE FAILURE RATE CALCULATION PROCEDURE FOR SEMICONDUCTOR COMPONENTS (Exception) 4.4 Failure analysis	Temperature : (55 ~ 150) °C	BS	N
JESD74A:2007	Electrical materials and components	EARLY LIFE FAILURE RATE CALCULATION PROCEDURE FOR SEMICONDUCTOR COMPONENTS (Exception) 4.4 Failure analysis	Temperature : (55 ~ 150) °C	BS-1	N
JESD78F:2022	Electrical materials and components	IC LATCH-UP TEST (Exception) 5.5 Latch-up detection criteria	Current : Max 2 A Voltage : Max 100 V	BS-2	N

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MIL-STD-202H:2015	Electrical materials and components	DEPARTMENT OF DEFENSE TEST METHOD STANDARD ELECTRONIC AND ELECTRICAL COMPONENT PARTS 101 Salt atmosphere (corrosion) (Exception) 4.2 Preparation of specimen 5.2 Measurement 103 Humidity (steady state) 107 Thermal shock 108 Life (at elevated ambient temperature) (Exception) 4.3 Measurements 201 Vibration (Exception) 5.1 Measurements 204 Vibration, high frequency (Exception) 4.7 Test condition F (3 000 Hz) 4.9 Test condition H (80g peak) 4.10 Alternate procedure for use of linear in place of logarithmic change of frequency 5.1 Measurements	101 : Temperature 35 °C , Salt solution : 5 % 103 : Conditioning Temperature : 40 °C , Exposure Humidity : (90 ~ 95) % R.H. Temperature : 40 °C 107 : (-65 ~ 150) °C 108 : (70 ~ 200) °C 201 : Frequency : (10 ~ 55) Hz, Displacement max 1.5 mm 204 : Frequency : (10 ~ 2 000) Hz , Acceleration : (100 ~ 500) m/s ²	BS	N
MIL-STD-202H:2015	Electrical materials and components	DEPARTMENT OF DEFENSE TEST METHOD STANDARD ELECTRONIC AND ELECTRICAL COMPONENT PARTS 103 Humidity (steady state) 107 Thermal shock (Exception) Table III. Thermal Shock conditions(liquid) 108 Life (at elevated ambient temperature) (Exception) 4.3 Measurements	103 : Conditioning Temperature : 40 °C Exposure Humidity : (90 ~ 95) % R.H. Temperature : 40 °C 107 : (-65 ~ 150) °C 108 : (70 ~ 200) °C	BS-1	N

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Test method	Materials/ Products	Standard designation	Test range	Site	Field testing
MIL-STD-810H:2019	Electrical materials and components	DEPARTMENT OF DEFENSE TEST METHOD STANDARD ENVIRONMENTAL ENGINEERING CONSIDERATIONS AND LABORATORY TESTS 501.7 High Temperature (Exception) 2.2.2 Procedure III Tactical-Standby to Operational 502.7 Low Temperature (Exception) 2.2.2 Procedure III Manipulation 503.7 Temperature Shock 507.6 Humidity Table 507.6-VIII Hot Humid - Natural Cycle B3. Table 507.6-IX Aggravated cycle 509.7 Salt Fog	501.7 : (30 ~ 71) °C 502.7 : (-61 ~ -21) °C 503.7 : (-61 ~ 71) °C 507.6 : (30 ~ 95) % R.H. , (30 ~ 60) °C 509.7 : Temperature 35 °C , Salt solution : 5 %	BS	N
MIL-STD-810H:2019	Electrical materials and components	DEPARTMENT OF DEFENSE TEST METHOD STANDARD ENVIRONMENTAL ENGINEERING CONSIDERATIONS AND LABORATORY TESTS 501.7 High Temperature (Exception) 2.2.2 Procedure III Tactical-Standby to Operational 502.7 Low Temperature (Exception) 2.2.2 Procedure III Manipulation 503.7 Temperature Shock 507.6 Humidity Table 507.6-VIII Hot Humid - Natural Cycle B3. Table 507.6-IX Aggravated cycle	501.7 : (30 ~ 71) °C 502.7 : (-61 ~ -21) °C 503.7 : (-61 ~ 71) °C 507.6 : Humidity:(30 ~ 95) % R.H. , Temperature:(30 ~ 60) °C	BS-1	N

End.