



Report No. MCR-25-0446
Date: December 1, 2025

RENESAS SEMICONDUCTOR RELIABILITY REPORT

DEVICE: RAJ2810024H12HPD

APPLICATION: Automotive

Quality Assurance Div.
Renesas Electronics Corporation

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Q100 Qualification Test Result for RAJ2810024H12HPD

| Test | # | Reference | Test Conditions | Lots | S.S. | Total | Results Lot/Pass/Fail | Comments: (N/A =Not Applicable) |
|------|---|-----------|-----------------|------|------|-------|--------------------------|------------------------------------|
|------|---|-----------|-----------------|------|------|-------|--------------------------|------------------------------------|

TEST GROUP A – ACCELERATED ENVIRONMENT STRESS TESTS

| | | | | | | | | |
|------|----|--------------------------|--|-------------|----|-----|----------|--|
| PC | A1 | JESD22 A113 J-STD-020 | Preconditioning: (Test @ Rm) SMD only; Moisture Preconditioning for THB, AC, TC, PTC; Peak Reflow Temp = 260°C | Min.MSL = 1 | | | MSL = 1 | |
| THB | A2 | JESD22 A101 | Temperature Humidity Bias: (Test @ Rm/Hot) Ta=85°C RH=85%, Specified Bias, 1000h | 3 | 77 | 231 | 0 of 231 | |
| UHST | A3 | JESD22 A102 | Autoclave: (Test @ Rm) Ta=130°C RH=85%, 96h | 3 | 77 | 231 | 0 of 231 | |
| TC | A4 | JESD22 A104 | Temperature Cycle: (Test @ Hot) Ta=-55°C to +150°C, 1000cycles | 3 | 77 | 231 | 0 of 231 | |
| PTC | A5 | JESD22 A105 | Power Temperature Cycle: (Test @ Rm/Hot) | 1 | 45 | 45 | 0 of 45 | |
| HTSL | A6 | JESD22 A103 | High Temperature Storage Life: (Test @ Rm/Hot) Ta=150°C, 1000h | 1 | 45 | 45 | 0 of 45 | |

| Test | # | Reference | Test Conditions | Lots | S.S. | Total | Results Lot/Pass/Fail | Comments: (N/A =Not Applicable) |
|------|---|-----------|-----------------|------|------|-------|--------------------------|------------------------------------|
|------|---|-----------|-----------------|------|------|-------|--------------------------|------------------------------------|

TEST GROUP B – ACCELERATED LIFETIME SIMULATION TESTS

| | | | | | | | | |
|------|----|--------------|---|---|-----|------|-----------|---------------------------------|
| HTOL | B1 | JESD22 A108 | High Temp Operating Life: (Test @ Rm/Hot/Cold) Ta=150°C, Specified Bias, 1000h | 3 | 77 | 231 | 0 of 231 | |
| ELFR | B2 | AEC-Q100-008 | Early Life Failure Rate: (Test @ Rm/Hot) Ta=150°C, Specified Bias, 24h | 3 | 800 | 2400 | 0 of 2400 | |
| EDR | B3 | AEC-Q100-005 | NVM Endurance & Data Retention Test: (Test @ Rm/Hot) | 3 | 77 | 231 | - | N/A Nonvolatile memory only. |

TEST GROUP C – PACKAGE ASSEMBLY INTEGRITY TESTS

| | | | | | | | | |
|-----|----|-----------------------------|--|---|-----------------|-----------|---------|----------------------------------|
| WBS | C1 | AEC-Q100-001 | Wire Bond Shear Test: (Cpk > 1.67) | 1 | 5 parts Min. | 30 bonds | 0 of 30 | Cpk > 1.67 |
| WBP | C2 | Mil-STD-883 Method 2011 | Wire Bond Pull initial: (Cpk > 1.67) | 1 | 5 parts Min. | 30 bonds | 0 of 30 | Cpk > 1.67 |
| SD | C3 | JESD22 B102 | Solderability: (>95% coverage) Steam aging: 8h | 1 | 15 | 15 | 0 of 15 | >95% coverage |
| PD | C4 | JESD22 B100, JESD22 B108 | Physical Dimensions: (Cpk > 1.67) | 3 | 10 | 30 | 0 of 30 | Cpk > 1.67 |
| SBS | C5 | AEC-Q100-010 | Solder Ball Shear: (Cpk > 1.67) | 3 | 10parts Min. | 150 balls | - | N/A BGA package only. |
| LI | C6 | JESD22 B105 | Lead Integrity: (No lead cracking or breaking); Through-hole only | 1 | 10parts Min. | 10 leads | - | N/A Through-hole device only. |

| Test | # | Reference | Test Conditions | Lots | S.S. | Total | Results Lot/Pass/Fail | Comments: (N/A =Not Applicable) |
|------|---|-----------|-----------------|------|------|-------|--------------------------|------------------------------------|
|------|---|-----------|-----------------|------|------|-------|--------------------------|------------------------------------|

TEST GROUP D – DIE FABRICATION RELIABILITY TESTS

| | | | | | | | | |
|-------|----|-----------------|--|---|---|---|------|------------------|
| EM | D1 | JESD61 | Electromigration: | - | - | - | PASS | Confirmed by TEG |
| TDDDB | D2 | JESD35 | Time Dependent Dielectric Breakdown: | - | - | - | PASS | Confirmed by TEG |
| HCI | D3 | JESD60 & 28 | Hot Carrier Injection: | - | - | - | PASS | Confirmed by TEG |
| NBTI | D4 | JESD90 | Negative Bias Temperature Instability: | - | - | - | PASS | Confirmed by TEG |
| SM | D5 | JESD61,87 & 202 | Stress Migration: | - | - | - | PASS | Confirmed by TEG |

| Test | # | Reference | Test Conditions | Lots | S.S. | Total | Results Lot/Pass/Fail | Comments: (N/A =Not Applicable) |
|------|---|-----------|-----------------|------|------|-------|--------------------------|------------------------------------|
|------|---|-----------|-----------------|------|------|-------|--------------------------|------------------------------------|

TEST GROUP E- ELECTRICAL VERIFICATION

| | | | | | | | | |
|------|-----|----------------------------------|--|-----|-----|-----|----------------------------------|--|
| TEST | E1 | User/Supplier Specification | Pre and Post Stress Electrical Test: | All | All | All | 0 of All | Refer to the each test items |
| HBM | E2 | AEC-Q100-002 | Electrostatic Discharge, Human Body Model: (Test @ Rm/Hot); (2KV HBM) | 1 | 3 | 3 | 0 of 3 ESD Level= HBM: 2 | HBM: 2KV Pass HBM Classification follows ANSI/ESDA/JEDEC JS-001-2017 |
| CDM | E3 | AEC-Q100-011 | Electrostatic Discharge, Charged Device Model: (Test @ Rm/Hot); (750V corner leads, 500V all other leads) | 1 | 3 | 3 | 0 of 3 ESD Level= CDM: C2a | Corner leads: 750V Pass All other leads: 500V Pass CDM Classification follows AEC-Q100-001 Rev. D |
| LU | E4 | AEC-Q100-004 | Latch-Up: (Test @ Rm/Hot) | - | - | - | - | N/A |
| ED | E5 | AEC-Q100-009 | Electrical Distributions: (Test @ Rm/Hot/Cold) (Cpk > 1.67) | 3 | 30 | 90 | 0 of 90 | Number of lots is fixed with customer's approval. Cpk > 1.67 |
| FG | E6 | AEC-Q100-007 | Fault Grading: | - | - | - | Fault Grade ≥98% | |
| CHAR | E7 | AEC-Q003 | Characterization: (Test @ Rm/Hot/Cold) | - | - | - | PASS | Completed in accordance with the Renesas standard procedure. |
| EMC | E9 | SAE J1752/3 | Electromagnetic Compatibility (Radiated Emissions): <40dBuV at 150KHz-1GHz | - | - | - | - | N/A |
| SC | E10 | AEC Q100-012 | Short Circuit Characterization | 3 | 10 | 30 | PASS | Cold Repetitive Short Circuit Test TSC 0/30 Cold Repetitive Short Circuit Test LSC 0/30 |
| SER | E11 | JESD89-1 JESD89-2 JESD89-3 | Soft Error Rate | 1 | 3 | 3 | - | N/A Device with memory only. |
| LI | E12 | AEC-Q005 | Lead (Pb) Free: (see AEC-Q005) | - | - | - | - | Solderability: See SD (C3) result. Solder heat resistance: N/A (Wave Solder is Not recommended.) Whisker: Performed on product TEG with test method based on JESD201 |

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|------|---|-----------|-----------------|------|------|-------|--------------------------|------------------------------------|
|------|---|-----------|-----------------|------|------|-------|--------------------------|------------------------------------|

TEST GROUP F – DEFECT SCREENING TESTS

| | | | | | | | | |
|-----|----|----------|---|---|---|---|---|---|
| PAT | F1 | AEC-Q001 | See AEC-Q001. This is highly recommended by Automotive Electronic Council to institute. | - | - | - | - | Apply to mass production according to Renesas standard procedure. |
| SBA | F2 | AEC-Q002 | See AEC-Q002. This is highly recommended by Automotive Electronic Council to institute. | - | - | - | - | Apply to mass production according to Renesas standard procedure. |

·Calculation method of standard failure rate

Operating reliability is decided by inherent reliability of device and environment condition of use (See below).

·Calculation method of standard failure rate (λ)

$$\lambda = \lambda_b \times \pi T \quad (\text{fit})$$

①Basic failure rate
②Temperature parameter

①Basic failure rate(λ_b)
DEVICE: RAJ2810024H12HPD λ_b : 5 (fit)

②Temperature parameter(πT)

$$\pi T = \exp \left(11600 \times E_a \times \left(\frac{1}{273+55} - \frac{1}{273+T_a} \right) \right)$$

Ea : 0.7eV (Activation energy)
 Ta : ambient temperature

| πT simplified chart | | | | | | | | | | |
|--------------------------|------|------|------|------|------|------|------|-------|-------|-------|
| Ta(j) | 40 | 55 | 60 | 65 | 70 | 75 | 80 | 90 | 100 | 110 |
| πT | 0.31 | 1.00 | 1.45 | 2.08 | 2.95 | 4.15 | 5.77 | 10.88 | 19.82 | 35.00 |

③MTTF (Mean Time to Failure)

$$\text{MTTF} = \frac{1}{\lambda}$$

·Confidence level 60% ·Standard temperature Ta = 55°C for LSI devices