

# RENESAS SEMICONDUCTOR RELIABILITY REPORT

GROUP : RX14T

DEVICE : R5F514TXXX

QUALITY GRADE : Standard

Quality Assurance Div.  
Renesas Electronics Corporation

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## Summary of Reliability Test Results for QFP Package (MSL3)

| Test Item                              | Reference              | Test Conditions                                               | Results Failure/Size | Comment                                                                           |
|----------------------------------------|------------------------|---------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------|
| High Temperature Operating Life (HTOL) | JESD22-A108            | Ta=125 °C, Vccmax, 1000 hrs                                   | 0/231                | 3 lots or more                                                                    |
| High Temperature Storage Life (HTSL)   | JESD22-A103            | Ta=150 °C, 1000 hrs                                           | 0/75                 | 3 lots or more                                                                    |
| Temperature Humidity bias (THB) (*1)   | JESD22-A101            | Ta=85 °C, RH=85 %, Vccmax, 1000 hrs                           | 0/75                 | 3 lots or more                                                                    |
| Temperature Humidity bias (HAST) (*1)  | JESD22-A110            | Ta=110 °C, RH=85 %, Vccmax, 264 hrs                           | 0/75                 | 3 lots or more                                                                    |
| Temperature Cycling (TC) (*1)          | JESD22-A104            | Ta=-65 °C to 150 °C , 500 cycles                              | 0/75                 | 3 lots or more                                                                    |
| Latch-Up (LU)                          | JESD78                 | Pulse Current Injection, I=+/-150 mA                          | 0/3                  |                                                                                   |
| Electrostatic discharge (ESD-HBM)      | JS-001                 | 1.5 kΩ, 100 pF, +/-2000 V, 1 time                             | 0/3                  | Class: 2                                                                          |
| Electrostatic discharge (ESD-CDM)      | JS-002                 | +/-500 V, 1 time                                              | 0/3                  | Class: C2a                                                                        |
| Solderability (SD)                     | J-STD-002              | 245 °C, 5 s, Solder coverage ≥95 %                            | 0/5                  |                                                                                   |
| Resistance to Soldering Heat (MSL3)    | JESD22-A113, J-STD-020 | MSL3(Moisture Sensitivity Level 3)<br>Peak Reflow Temp=260 °C | Pass                 | Verified after MSL preconditioning; applied to applicable reliability tests (*1). |

## Note :

- (\*1) With preconditioning per JESD22-A113, MSL 3
- It is tested to confirm that all the samples are satisfied with an individual product specification.
- Basically qualification tests were performed using a representative product with the same wafer process and the same package structure .

## Summary of Reliability Test Results for QFN Package (MSL3)

| Test Item                              | Reference              | Test Conditions                                               | Results Failure/Size | Comment                                                                           |
|----------------------------------------|------------------------|---------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------------|
| High Temperature Operating Life (HTOL) | JESD22-A108            | Ta=125 °C, Vccmax, 1000 hrs                                   | 0/231                | 3 lots or more                                                                    |
| High Temperature Storage Life (HTSL)   | JESD22-A103            | Ta=150 °C, 1000 hrs                                           | 0/75                 | 3 lots or more                                                                    |
| Temperature Humidity bias (THB) (*1)   | JESD22-A101            | Ta=85 °C, RH=85 %, Vccmax, 1000 hrs                           | 0/25                 |                                                                                   |
| Temperature Humidity bias (HAST) (*1)  | JESD22-A110            | Ta=110 °C, RH=85 %, Vccmax, 264 hrs                           | 0/75                 | 3 lots or more                                                                    |
| Temperature Cycling (TC) (*1)          | JESD22-A104            | Ta=-65 °C to 150 °C , 500 cycles                              | 0/75                 | 3 lots or more                                                                    |
| Latch-Up (LU)                          | JESD78                 | Pulse Current Injection, I=+/-150 mA                          | 0/3                  |                                                                                   |
| Electrostatic discharge (ESD-HBM)      | JS-001                 | 1.5 kΩ, 100 pF, +/-2000 V, 1 time                             | 0/3                  | Class: 2                                                                          |
| Electrostatic discharge (ESD-CDM)      | JS-002                 | +/-500 V, 1 time                                              | 0/3                  | Class: C2a                                                                        |
| Solderability (SD)                     | J-STD-002              | 245 °C, 5 s, Solder coverage ≥95 %                            | 0/5                  |                                                                                   |
| Resistance to Soldering Heat (MSL3)    | JESD22-A113, J-STD-020 | MSL3(Moisture Sensitivity Level 3)<br>Peak Reflow Temp=260 °C | Pass                 | Verified after MSL preconditioning; applied to applicable reliability tests (*1). |

## Note :

- (\*1) With preconditioning per JESD22-A113, MSL 3
- It is tested to confirm that all the samples are satisfied with an individual product specification.
- Basically qualification tests were performed using a representative product with the same wafer process and the same package structure .

The failure rate of the device in an actual use condition can be estimated by the below procedure.

•Equation for the failure rate estimation ( $\lambda$ )

$$\lambda = \lambda b \times \pi T \text{ (FIT)}$$

①Unique failure rate ( $\lambda b$ )

$\lambda b= 4.1 \text{ FIT}$

Unique failure rate at  $T_a=55 \text{ }^{\circ}\text{C}$  using 60 % confidence level.

②Temperature term ( $\pi T$ )

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

$E_a$  : Activation energy (eV)

$T_a$  : Ambient temperature ( $^{\circ}\text{C}$ )

| $\pi T$ simplified chart as $E_a=0.7 \text{ eV}$ |      |      |    |      |      |      |      |      |      |       |       |       |
|--------------------------------------------------|------|------|----|------|------|------|------|------|------|-------|-------|-------|
| $T_a$<br>( $^{\circ}\text{C}$ )                  | 40   | 50   | 55 | 60   | 65   | 70   | 75   | 80   | 85   | 90    | 100   | 110   |
| $\pi T$                                          | 0.31 | 0.68 | 1  | 1.45 | 2.08 | 2.95 | 4.15 | 5.77 | 7.96 | 10.88 | 19.82 | 34.99 |

•MTTF ( Mean Time To Failure )

$$MTTF = 1/\lambda$$

Reference about Renesas package code

| Package type                    |       | Package code *1 |
|---------------------------------|-------|-----------------|
| Lead type plastic package       | QFP   | PxQP            |
|                                 | SOP   | PxSP            |
| Non-lead type plastic package   | QFN   | PxQN            |
| Grid array type plastic package | BGA   | PxBG            |
|                                 | LGA   | PxLG            |
| Wafer level chip scale package  | WLCSP | SxBG            |

\*1. First four digit

Table. Product list

| No | Product part number | Package code | MSL  | No  | Product part number | Package code | MSL |
|----|---------------------|--------------|------|-----|---------------------|--------------|-----|
| 1  | R5F514T5AGFD        | PLQP0052J*   | MSL3 | 51  |                     |              |     |
| 2  | R5F514T5AMFD        | PLQP0052J*   | MSL3 | 52  |                     |              |     |
| 3  | R5F514T5AGFJ        | PLQP0032G*   | MSL3 | 53  |                     |              |     |
| 4  | R5F514T5AMFJ        | PLQP0032G*   | MSL3 | 54  |                     |              |     |
| 5  | R5F514T5AGFK        | PLQP0064G*   | MSL3 | 55  |                     |              |     |
| 6  | R5F514T5AMFK        | PLQP0064G*   | MSL3 | 56  |                     |              |     |
| 7  | R5F514T5AGFL        | PLQP0048K*   | MSL3 | 57  |                     |              |     |
| 8  | R5F514T5AMFL        | PLQP0048K*   | MSL3 | 58  |                     |              |     |
| 9  | R5F514T5AGFM        | PLQP0064K*   | MSL3 | 59  |                     |              |     |
| 10 | R5F514T5AMFM        | PLQP0064K*   | MSL3 | 60  |                     |              |     |
| 11 | R5F514T5AGFV        | PLQP0044G*   | MSL3 | 61  |                     |              |     |
| 12 | R5F514T5AGNE        | PWQN0048K*   | MSL3 | 62  |                     |              |     |
| 13 | R5F514T5AMNE        | PWQN0048K*   | MSL3 | 63  |                     |              |     |
| 14 | R5F514T5AGNH        | PWQN0032K*   | MSL3 | 64  |                     |              |     |
| 15 | R5F514T5AMNH        | PWQN0032K*   | MSL3 | 65  |                     |              |     |
| 16 | R5F514T5AGNK        | PWQN0024K*   | MSL3 | 66  |                     |              |     |
| 17 | R5F514T5AMNK        | PWQN0024K*   | MSL3 | 67  |                     |              |     |
| 18 |                     |              |      | 68  |                     |              |     |
| 19 |                     |              |      | 69  |                     |              |     |
| 20 |                     |              |      | 70  |                     |              |     |
| 21 |                     |              |      | 71  |                     |              |     |
| 22 |                     |              |      | 72  |                     |              |     |
| 23 |                     |              |      | 73  |                     |              |     |
| 24 |                     |              |      | 74  |                     |              |     |
| 25 |                     |              |      | 75  |                     |              |     |
| 26 |                     |              |      | 76  |                     |              |     |
| 27 |                     |              |      | 77  |                     |              |     |
| 28 |                     |              |      | 78  |                     |              |     |
| 29 |                     |              |      | 79  |                     |              |     |
| 30 |                     |              |      | 80  |                     |              |     |
| 31 |                     |              |      | 81  |                     |              |     |
| 32 |                     |              |      | 82  |                     |              |     |
| 33 |                     |              |      | 83  |                     |              |     |
| 34 |                     |              |      | 84  |                     |              |     |
| 35 |                     |              |      | 85  |                     |              |     |
| 36 |                     |              |      | 86  |                     |              |     |
| 37 |                     |              |      | 87  |                     |              |     |
| 38 |                     |              |      | 88  |                     |              |     |
| 39 |                     |              |      | 89  |                     |              |     |
| 40 |                     |              |      | 90  |                     |              |     |
| 41 |                     |              |      | 91  |                     |              |     |
| 42 |                     |              |      | 92  |                     |              |     |
| 43 |                     |              |      | 93  |                     |              |     |
| 44 |                     |              |      | 94  |                     |              |     |
| 45 |                     |              |      | 95  |                     |              |     |
| 46 |                     |              |      | 96  |                     |              |     |
| 47 |                     |              |      | 97  |                     |              |     |
| 48 |                     |              |      | 98  |                     |              |     |
| 49 |                     |              |      | 99  |                     |              |     |
| 50 |                     |              |      | 100 |                     |              |     |

Note: MSL stands for Moisture Sensitivity Level.