

# **RENESAS SEMICONDUCTOR RELIABILITY REPORT**

GROUP : RA4M3  
DEVICE : R7FA4M3XXX  
APPLICATION : Consumer / Industry

Quality Assurance Div.  
Renesas Electronics Corporation

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**Table. Reliability test results (QFP)**

| Test Items                             | Reference              | Test Conditions                      | Results<br>Failure/Size | Comment   |
|----------------------------------------|------------------------|--------------------------------------|-------------------------|-----------|
| High Temperature Operating Life (HTOL) | JESD22-A108            | Ta=125 °C, Vccmax, 1000 hrs          | 0/22                    |           |
| High Temperature Storage Life (HTSL)   | JESD22-A103            | Ta=150 °C, 1000 hrs                  | 0/22                    |           |
| Temperature Humidity bias (THB) (*1)   | JESD22-A101            | Ta=85 °C, RH=85 %, Vccmax, 1000 hrs  | 0/22                    |           |
| Temperature Cycling (TC) (*1)          | JESD22-A104            | Ta=-65 °C to 150 °C , 300 cycles     | 0/22                    |           |
| 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)      | JESD22-C101            | +/-500V,1time                        | 0/3                     | Class: C2 |
| Solderability (SD)                     | J-STD-002              | 245 °C, 5 s, Solder coverage ≥95 %   | 0/5                     |           |
| Resistance to Soldering Heat (PC)      | JESD22-A113, J-STD-020 | MSL3(Moisture Sensitivity Level 3)   | 0/22                    |           |

\*1) With preconditioning per JESD22-A113, MSL 3

·It is tested to confirm that all the samples are satisfied with an individual product specification.

Note :

Basically qualification tests were performed using a representative product with the same wafer process and the same package structure .

**Table. Reliability test results (BGA)**

| Test Items                                | Reference                 | Test Conditions                      | Results<br>Failure/Size | Comment   |
|-------------------------------------------|---------------------------|--------------------------------------|-------------------------|-----------|
| High Temperature Operating Life<br>(HTOL) | JESD22-A108               | Ta=125 °C, Vccmax, 1000 hrs          | 0/22                    |           |
| High Temperature Storage Life<br>(HTSL)   | JESD22-A103               | Ta=150 °C, 1000 hrs                  | 0/22                    |           |
| Temperature Humidity bias<br>(THB) (*1)   | JESD22-A101               | Ta=85 °C, RH=85 %, Vccmax, 1000 hrs  | 0/22                    |           |
| Temperature Cycling<br>(TC) (*1)          | JESD22-A104               | Ta=-55 °C to 125 °C , 500 cycles     | 0/22                    |           |
| Latch-Up<br>(LU)                          | JESD78                    | Pulse Current Injection, I=+/-150 mA | 0/3                     |           |
| Electrostatic discharge<br>(ESD-HBM)      | JS-001                    | 1.5 kΩ, 100 pF, +/-2000 V, 1 time    | 0/3                     | Class: 2  |
| Electrostatic discharge<br>(ESD-CDM)      | JESD22-C101               | +/-500V,1time                        | 0/3                     | Class: C2 |
| Resistance to Soldering Heat<br>(PC)      | JESD22-A113,<br>J-STD-020 | MSL3(Moisture Sensitivity Level 3)   | 0/22                    |           |

\*1) With preconditioning per JESD22-A113, MSL 3

•It is tested to confirm that all the samples are satisfied with an individual product specification.

Note :

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 ( $\lambda_b$ )

$$\lambda_b = 0.08 \text{ FIT}$$

Unique failure rate at  $T_a=55^\circ\text{C}$  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            |
| Non-lead type plastic package   | QFN | PxQN            |
| Grid array type plastic package | BGA | PxBG            |
|                                 | LGA | PxLG            |

\*1. First four digit

Table. Product list

| No | Group | Product part number | Package code | No  | Group | Product part number | Package code |
|----|-------|---------------------|--------------|-----|-------|---------------------|--------------|
| 1  | RA4M3 | R7FA4M3AD2CBM       | PLBG0144K*   | 51  |       |                     |              |
| 2  | RA4M3 | R7FA4M3AD3CBM       | PLBG0144K*   | 52  |       |                     |              |
| 3  | RA4M3 | R7FA4M3AE2CBM       | PLBG0144K*   | 53  |       |                     |              |
| 4  | RA4M3 | R7FA4M3AE3CBM       | PLBG0144K*   | 54  |       |                     |              |
| 5  | RA4M3 | R7FA4M3AF2CBM       | PLBG0144K*   | 55  |       |                     |              |
| 6  | RA4M3 | R7FA4M3AF3CBM       | PLBG0144K*   | 56  |       |                     |              |
| 7  | RA4M3 | R7FA4M3AD2CBQ       | PLBG0064J*   | 57  |       |                     |              |
| 8  | RA4M3 | R7FA4M3AD3CBQ       | PLBG0064J*   | 58  |       |                     |              |
| 9  | RA4M3 | R7FA4M3AE2CBQ       | PLBG0064J*   | 59  |       |                     |              |
| 10 | RA4M3 | R7FA4M3AE3CBQ       | PLBG0064J*   | 60  |       |                     |              |
| 11 | RA4M3 | R7FA4M3AF2CBQ       | PLBG0064J*   | 61  |       |                     |              |
| 12 | RA4M3 | R7FA4M3AF3CBQ       | PLBG0064J*   | 62  |       |                     |              |
| 13 | RA4M3 | R7FA4M3AD3CFB       | PLQP0144K*   | 63  |       |                     |              |
| 14 | RA4M3 | R7FA4M3AE3CFB       | PLQP0144K*   | 64  |       |                     |              |
| 15 | RA4M3 | R7FA4M3AF3CFB       | PLQP0144K*   | 65  |       |                     |              |
| 16 | RA4M3 | R7FA4M3AE3CFM       | PLQP0064K*   | 66  |       |                     |              |
| 17 | RA4M3 | R7FA4M3AF3CFM       | PLQP0064K*   | 67  |       |                     |              |
| 18 | RA4M3 | R7FA4M3AE3CFP       | PLQP0100K*   | 68  |       |                     |              |
| 19 | RA4M3 | R7FA4M3AF3CFP       | PLQP0100K*   | 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 |       |                     |              |