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RENESAS SEMICONDUCTOR RELIABILITY REPORT

GROUP : RX111

DEVICE : R5F5111XXX

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 ℃, Vccmax, 1000 hrs	0/231	3 lots or more
High Temperature Storage Life (HTSL)	JESD22-A103	Ta=150 ℃, 1000 hrs	0/75	3 lots or more
Temperature Humidity bias (THB) (*1)	JESD22-A101	Ta=85 ℃, RH=85 %, Vccmax, 1000 hrs	0/75	3 lots or more
Temperature Cycling (TC) (*1)	JESD22-A104	Ta=-65 ℃ to 150 ℃ , 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)	JEITA ED-4701/302	+/-1000 V,1 time	0/3	Class: Equivalent to C2b
Solderability (SD)	J-STD-002	245 ℃, 5 s, Solder coverage ≥95 %	0/5	
Resistance to Soldering Heat (MSL3)	JESD22-A113, J-STD-020	MSL3(Moisture Sensitivity Level 3) 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 ℃, Vccmax, 1000 hrs	0/231	3 lots or more
High Temperature Storage Life (HTSL)	JESD22-A103	Ta=150 ℃, 1000 hrs	0/75	3 lots or more
Temperature Humidity bias (THB) (*1)	JESD22-A101	Ta=85 ℃, RH=85 %, Vccmax, 1000 hrs	0/75	3 lots or more
Temperature Cycling (TC) (*1)	JESD22-A104	Ta=-65 ℃ to 150 ℃ , 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)	JEITA ED-4701/302	+/-1000 V,1 time	0/3	Class: Equivalent to C2b
Solderability (SD)	J-STD-002	245 ℃, 5 s, Solder coverage ≥95 %	0/5	
Resistance to Soldering Heat (MSL3)	JESD22-A113, J-STD-020	MSL3(Moisture Sensitivity Level 3) 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 LGA Package (MSL3)

Test Item	Reference	Test Conditions	Results Failure/Size	Comment
High Temperature Operating Life (HTOL)	JESD22-A108	Ta=125 ℃, Vccmax, 1000 hrs	0/231	3 lots or more
High Temperature Storage Life (HTSL)	JESD22-A103	Ta=150 ℃, 1000 hrs	0/75	3 lots or more
Temperature Humidity bias (THB) (*1)	JESD22-A101	Ta=85 ℃, RH=85 %, Vccmax, 1000 hrs	0/75	3 lots or more
Temperature Cycling (TC) (*1)	JESD22-A104	Ta=-55 ℃ to 125 ℃ , 700 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)	JEITA ED-4701/302	+/-1000 V,1 time	0/3	Class: Equivalent to C2b
Resistance to Soldering Heat (MSL3)	JESD22-A113, J-STD-020	MSL3(Moisture Sensitivity Level 3) 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 (λ)

$\lambda = \lambda b \times \pi T$ *(FIT)*

①Unique failure rate (λb)

λb= 2.0 FIT

Unique failure rate at Ta=55 ℃ using 60 % confidence level.

②Temperature term (πT)

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

Ea： Activation energy（eV)
Ta： Ambient temperature（℃)

πT simplified chart as Ea=0.7 eV												
Ta (℃)	40	50	55	60	65	70	75	80	85	90	100	110
πT	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
1	R5F51111ADFK	PLQP0064G*	MSL3
2	R5F51111AGFK	PLQP0064G*	MSL3
3	R5F51113ADFK	PLQP0064G*	MSL3
4	R5F51113AGFK	PLQP0064G*	MSL3
5	R5F51114ADFK	PLQP0064G*	MSL3
6	R5F51114AGFK	PLQP0064G*	MSL3
7	R5F51115ADFK	PLQP0064G*	MSL3
8	R5F51115AGFK	PLQP0064G*	MSL3
9	R5F51116ADFK	PLQP0064G*	MSL3
10	R5F51116AGFK	PLQP0064G*	MSL3
11	R5F51117ADFK	PLQP0064G*	MSL3
12	R5F51117AGFK	PLQP0064G*	MSL3
13	R5F51118ADFK	PLQP0064G*	MSL3
14	R5F51118AGFK	PLQP0064G*	MSL3
15	R5F5111JADFK	PLQP0064G*	MSL3
16	R5F5111JAGFK	PLQP0064G*	MSL3
17	R5F51111ADFL	PLQP0048K*	MSL3
18	R5F51111AGFL	PLQP0048K*	MSL3
19	R5F51113ADFL	PLQP0048K*	MSL3
20	R5F51113AGFL	PLQP0048K*	MSL3
21	R5F51114ADFL	PLQP0048K*	MSL3
22	R5F51114AGFL	PLQP0048K*	MSL3
23	R5F51115ADFL	PLQP0048K*	MSL3
24	R5F51115AGFL	PLQP0048K*	MSL3
25	R5F51116ADFL	PLQP0048K*	MSL3
26	R5F51116AGFL	PLQP0048K*	MSL3
27	R5F51117ADFL	PLQP0048K*	MSL3
28	R5F51117AGFL	PLQP0048K*	MSL3
29	R5F51118ADFL	PLQP0048K*	MSL3
30	R5F51118AGFL	PLQP0048K*	MSL3
31	R5F5111JADFL	PLQP0048K*	MSL3
32	R5F5111JAGFL	PLQP0048K*	MSL3
33	R5F51111ADFM	PLQP0064K*	MSL3
34	R5F51111AGFM	PLQP0064K*	MSL3
35	R5F51113ADFM	PLQP0064K*	MSL3
36	R5F51113AGFM	PLQP0064K*	MSL3
37	R5F51114ADFM	PLQP0064K*	MSL3
38	R5F51114AGFM	PLQP0064K*	MSL3
39	R5F51115ADFM	PLQP0064K*	MSL3
40	R5F51115AGFM	PLQP0064K*	MSL3
41	R5F51116ADFM	PLQP0064K*	MSL3
42	R5F51116AGFM	PLQP0064K*	MSL3
43	R5F51117ADFM	PLQP0064K*	MSL3
44	R5F51117AGFM	PLQP0064K*	MSL3
45	R5F51118ADFM	PLQP0064K*	MSL3
46	R5F51118AGFM	PLQP0064K*	MSL3
47	R5F5111JADFM	PLQP0064K*	MSL3
48	R5F5111JAGFM	PLQP0064K*	MSL3
49	R5F51111ADLF	PWLG0064K*	MSL3
50	R5F51113ADLF	PWLG0064K*	MSL3
51	R5F51114ADLF	PWLG0064K*	MSL3
52	R5F51115ADLF	PWLG0064K*	MSL3
53	R5F51116ADLF	PWLG0064K*	MSL3
54	R5F51117ADLF	PWLG0064K*	MSL3
55	R5F51118ADLF	PWLG0064K*	MSL3
56	R5F5111JADLF	PWLG0064K*	MSL3
57	R5F51111ADLM	PWLG0036K*	MSL3
58	R5F51113ADLM	PWLG0036K*	MSL3
59	R5F5111JADLM	PWLG0036K*	MSL3
60	R5F51111ADNE	PWQN0048K*	MSL3
61	R5F51111AGNE	PWQN0048K*	MSL3
62	R5F51113ADNE	PWQN0048K*	MSL3
63	R5F51113AGNE	PWQN0048K*	MSL3
64	R5F51114ADNE	PWQN0048K*	MSL3
65	R5F51114AGNE	PWQN0048K*	MSL3
66	R5F51115ADNE	PWQN0048K*	MSL3
67	R5F51115AGNE	PWQN0048K*	MSL3
68	R5F51116ADNE	PWQN0048K*	MSL3
69	R5F51116AGNE	PWQN0048K*	MSL3
70	R5F51117ADNE	PWQN0048K*	MSL3
71	R5F51117AGNE	PWQN0048K*	MSL3
72	R5F51118ADNE	PWQN0048K*	MSL3
73	R5F51118AGNE	PWQN0048K*	MSL3
74	R5F5111JADNE	PWQN0048K*	MSL3
75	R5F5111JAGNE	PWQN0048K*	MSL3
76	R5F51111ADNF	PWQN0040K*	MSL3
77	R5F51111AGNF	PWQN0040K*	MSL3
78	R5F51113ADNF	PWQN0040K*	MSL3
79	R5F51113AGNF	PWQN0040K*	MSL3
80	R5F5111JADNF	PWQN0040K*	MSL3
81	R5F5111JAGNF	PWQN0040K*	MSL3
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Note: MSL stands for Moisture Sensitivity Level.