

RENESAS SEMICONDUCTOR RELIABILITY REPORT

GROUP : RX140

DEVICE : R5F5140XXX

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, +/-1000 V, 1 time	0/3	Class: 1C
Electrostatic discharge (ESD-CDM)	JESD22-C101	+/-500 V, 1 time	0/3	Class: C2
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) 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, +/-1000 V, 1 time	0/3	Class: 1C
Electrostatic discharge (ESD-CDM)	JESD22-C101	+/-500 V, 1 time	0/3	Class: C2
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) 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)

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

①Unique failure rate (λb)
 $\lambda b = 4.1 \text{ FIT}$
Unique failure rate at $T_a = 55^\circ\text{C}$ using 60 % confidence level.

②Temperature term (πT)
$$\pi T = \exp\{11600 \times E_a \times (1/(273+55) - 1/(273+T_a))\}$$

E_a : Activation energy (eV)
 T_a : Ambient temperature ($^\circ\text{C}$)

πT simplified chart as $E_a = 0.7 \text{ eV}$												
T_a ($^\circ\text{C}$)	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	No	Product part number	Package code	MSL
1	R5F51403ADFJ	PLQP0032G*	MSL3	51	R5F51403ADNH	PWQN0032K*	MSL3
2	R5F51403AGFJ	PLQP0032G*	MSL3	52	R5F51403AGNH	PWQN0032K*	MSL3
3	R5F51403ADFK	PLQP0064G*	MSL3	53			
4	R5F51403AGFK	PLQP0064G*	MSL3	54			
5	R5F51405ADFK	PLQP0064G*	MSL3	55			
6	R5F51405AGFK	PLQP0064G*	MSL3	56			
7	R5F51405BDFK	PLQP0064G*	MSL3	57			
8	R5F51405BGFK	PLQP0064G*	MSL3	58			
9	R5F51406ADFK	PLQP0064G*	MSL3	59			
10	R5F51406AGFK	PLQP0064G*	MSL3	60			
11	R5F51406BDFK	PLQP0064G*	MSL3	61			
12	R5F51406BGFK	PLQP0064G*	MSL3	62			
13	R5F51403ADFL	PLQP0048K*	MSL3	63			
14	R5F51403AGFL	PLQP0048K*	MSL3	64			
15	R5F51405ADFL	PLQP0048K*	MSL3	65			
16	R5F51405AGFL	PLQP0048K*	MSL3	66			
17	R5F51405BDFL	PLQP0048K*	MSL3	67			
18	R5F51405BGFL	PLQP0048K*	MSL3	68			
19	R5F51406ADFL	PLQP0048K*	MSL3	69			
20	R5F51406AGFL	PLQP0048K*	MSL3	70			
21	R5F51406BDFL	PLQP0048K*	MSL3	71			
22	R5F51406BGFL	PLQP0048K*	MSL3	72			
23	R5F51403ADFM	PLQP0064K*	MSL3	73			
24	R5F51403AGFM	PLQP0064K*	MSL3	74			
25	R5F51405ADFM	PLQP0064K*	MSL3	75			
26	R5F51405AGFM	PLQP0064K*	MSL3	76			
27	R5F51405BDFM	PLQP0064K*	MSL3	77			
28	R5F51405BGFM	PLQP0064K*	MSL3	78			
29	R5F51406ADFM	PLQP0064K*	MSL3	79			
30	R5F51406AGFM	PLQP0064K*	MSL3	80			
31	R5F51406BDFM	PLQP0064K*	MSL3	81			
32	R5F51406BGFM	PLQP0064K*	MSL3	82			
33	R5F51405ADFN	PLQP0080K*	MSL3	83			
34	R5F51405AGFN	PLQP0080K*	MSL3	84			
35	R5F51405BDFN	PLQP0080K*	MSL3	85			
36	R5F51405BGFN	PLQP0080K*	MSL3	86			
37	R5F51406ADFN	PLQP0080K*	MSL3	87			
38	R5F51406AGFN	PLQP0080K*	MSL3	88			
39	R5F51406BDFN	PLQP0080K*	MSL3	89			
40	R5F51406BGFN	PLQP0080K*	MSL3	90			
41	R5F51403ADNE	PWQN0048K*	MSL3	91			
42	R5F51403AGNE	PWQN0048K*	MSL3	92			
43	R5F51405ADNE	PWQN0048K*	MSL3	93			
44	R5F51405AGNE	PWQN0048K*	MSL3	94			
45	R5F51405BDNE	PWQN0048K*	MSL3	95			
46	R5F51405BGNE	PWQN0048K*	MSL3	96			
47	R5F51406ADNE	PWQN0048K*	MSL3	97			
48	R5F51406AGNE	PWQN0048K*	MSL3	98			
49	R5F51406BDNE	PWQN0048K*	MSL3	99			
50	R5F51406BGNE	PWQN0048K*	MSL3	100			

Note: MSL stands for Moisture Sensitivity Level.