

RENESAS SEMICONDUCTOR RELIABILITY REPORT

GROUP : RX66N

DEVICE : R5F566NXXX

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)	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 BGA 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=-55 °C to 125 °C , 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)	JESD22-C101	+/-500 V, 1 time	0/3	Class: C2
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 °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=-55 °C to 125 °C , 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)	JESD22-C101	+/-500 V, 1 time	0/3	Class: C2
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)

$\lambda b= 0.007 \text{ FIT}$

Unique failure rate at $Ta=55 \text{ }^{\circ}\text{C}$ 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 ($^{\circ}\text{C}$)

πT simplified chart as $Ea=0.7 \text{ eV}$												
Ta ($^{\circ}\text{C}$)	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	R5F566NDDDBD	PLBG0224G*	MSL3	51			
2	R5F566NDDGBD	PLBG0224G*	MSL3	52			
3	R5F566NDHDBD	PLBG0224G*	MSL3	53			
4	R5F566NDHGBD	PLBG0224G*	MSL3	54			
5	R5F566NNDDDBD	PLBG0224G*	MSL3	55			
6	R5F566NNDDGBD	PLBG0224G*	MSL3	56			
7	R5F566NNHDBD	PLBG0224G*	MSL3	57			
8	R5F566NNHGBD	PLBG0224G*	MSL3	58			
9	R5F566NDDDBG	PLBG0176G*	MSL3	59			
10	R5F566NDDGBG	PLBG0176G*	MSL3	60			
11	R5F566NDHDBG	PLBG0176G*	MSL3	61			
12	R5F566NDHGBG	PLBG0176G*	MSL3	62			
13	R5F566NNDDBG	PLBG0176G*	MSL3	63			
14	R5F566NNDDGBG	PLBG0176G*	MSL3	64			
15	R5F566NNHDBG	PLBG0176G*	MSL3	65			
16	R5F566NNHGBG	PLBG0176G*	MSL3	66			
17	R5F566NDDDFB	PLQP0144K*	MSL3	67			
18	R5F566NDDGFB	PLQP0144K*	MSL3	68			
19	R5F566NDHDFB	PLQP0144K*	MSL3	69			
20	R5F566NDHGFB	PLQP0144K*	MSL3	70			
21	R5F566NNDDFB	PLQP0144K*	MSL3	71			
22	R5F566NNDGFB	PLQP0144K*	MSL3	72			
23	R5F566NNHDFB	PLQP0144K*	MSL3	73			
24	R5F566NNHGFB	PLQP0144K*	MSL3	74			
25	R5F566NDDDFC	PLQP0176K*	MSL3	75			
26	R5F566NDDGFC	PLQP0176K*	MSL3	76			
27	R5F566NDHDFC	PLQP0176K*	MSL3	77			
28	R5F566NDHGFC	PLQP0176K*	MSL3	78			
29	R5F566NNDDFC	PLQP0176K*	MSL3	79			
30	R5F566NNDGFC	PLQP0176K*	MSL3	80			
31	R5F566NNHDFC	PLQP0176K*	MSL3	81			
32	R5F566NNHGFC	PLQP0176K*	MSL3	82			
33	R5F566NDDDFP	PLQP0100K*	MSL3	83			
34	R5F566NDDGFP	PLQP0100K*	MSL3	84			
35	R5F566NDHDFP	PLQP0100K*	MSL3	85			
36	R5F566NDHGFP	PLQP0100K*	MSL3	86			
37	R5F566NDUDFP	PLQP0100K*	MSL3	87			
38	R5F566NNDDFP	PLQP0100K*	MSL3	88			
39	R5F566NNDGFP	PLQP0100K*	MSL3	89			
40	R5F566NNHDFP	PLQP0100K*	MSL3	90			
41	R5F566NNHGFP	PLQP0100K*	MSL3	91			
42	R5F566NNUDFP	PLQP0100K*	MSL3	92			
43	R5F566NDDDLK	PTLG0145K*	MSL3	93			
44	R5F566NDDGLK	PTLG0145K*	MSL3	94			
45	R5F566NDHDLK	PTLG0145K*	MSL3	95			
46	R5F566NDHGLK	PTLG0145K*	MSL3	96			
47	R5F566NNDDLK	PTLG0145K*	MSL3	97			
48	R5F566NNDGLK	PTLG0145K*	MSL3	98			
49	R5F566NNHDLK	PTLG0145K*	MSL3	99			
50	R5F566NNHGLK	PTLG0145K*	MSL3	100			

Note: MSL stands for Moisture Sensitivity Level.