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RENESAS SEMICONDUCTOR RELIABILITY REPORT

GROUP : RX23E-B

DEVICE : R5F523EXXX (RX23E-B)

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)	JESD22-C101	+/-500 V,1 time	0/3	Class: C2
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)	JESD22-C101	+/-500 V,1 time	0/3	Class: C2
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 BGA 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)	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)

$\lambda = \lambda b \times \pi T$ *(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	No	Product part number	Package code	MSL
1	R5F523E5LDBS	PTBG0100K*	MSL3	51	R5F523E6BDNF	PWQN0040K*	MSL3
2	R5F523E5LGBS	PTBG0100K*	MSL3	52	R5F523E6BGNF	PWQN0040K*	MSL3
3	R5F523E5NDBS	PTBG0100K*	MSL3	53	R5F523E6KDNF	PWQN0040K*	MSL3
4	R5F523E5NGBS	PTBG0100K*	MSL3	54	R5F523E6KGNF	PWQN0040K*	MSL3
5	R5F523E6LDBS	PTBG0100K*	MSL3	55	R5F523E6MDNF	PWQN0040K*	MSL3
6	R5F523E6LGBS	PTBG0100K*	MSL3	56	R5F523E6MGNF	PWQN0040K*	MSL3
7	R5F523E6NDBS	PTBG0100K*	MSL3	57			
8	R5F523E6NGBS	PTBG0100K*	MSL3	58			
9	R5F523E5BDFL	PLQP0048K*	MSL3	59			
10	R5F523E5BGFL	PLQP0048K*	MSL3	60			
11	R5F523E5MDFL	PLQP0048K*	MSL3	61			
12	R5F523E5MGFL	PLQP0048K*	MSL3	62			
13	R5F523E6BDFL	PLQP0048K*	MSL3	63			
14	R5F523E6BGFL	PLQP0048K*	MSL3	64			
15	R5F523E6MDFL	PLQP0048K*	MSL3	65			
16	R5F523E6MGFL	PLQP0048K*	MSL3	66			
17	R5F523E5BDFM	PLQP0064K*	MSL3	67			
18	R5F523E5BGFM	PLQP0064K*	MSL3	68			
19	R5F523E5KDFM	PLQP0064K*	MSL3	69			
20	R5F523E5KGFM	PLQP0064K*	MSL3	70			
21	R5F523E5MDFM	PLQP0064K*	MSL3	71			
22	R5F523E5MGFM	PLQP0064K*	MSL3	72			
23	R5F523E6BDFM	PLQP0064K*	MSL3	73			
24	R5F523E6BGFM	PLQP0064K*	MSL3	74			
25	R5F523E6KDFM	PLQP0064K*	MSL3	75			
26	R5F523E6KGFM	PLQP0064K*	MSL3	76			
27	R5F523E6MDFM	PLQP0064K*	MSL3	77			
28	R5F523E6MGFM	PLQP0064K*	MSL3	78			
29	R5F523E5JDFN	PLQP0080K*	MSL3	79			
30	R5F523E5JGFN	PLQP0080K*	MSL3	80			
31	R5F523E5NDFN	PLQP0080K*	MSL3	81			
32	R5F523E5NGFN	PLQP0080K*	MSL3	82			
33	R5F523E6JDFN	PLQP0080K*	MSL3	83			
34	R5F523E6JGFN	PLQP0080K*	MSL3	84			
35	R5F523E6NDFN	PLQP0080K*	MSL3	85			
36	R5F523E6NGFN	PLQP0080K*	MSL3	86			
37	R5F523E5LDFP	PLQP0100K*	MSL3	87			
38	R5F523E5LGFP	PLQP0100K*	MSL3	88			
39	R5F523E5NDFP	PLQP0100K*	MSL3	89			
40	R5F523E5NGFP	PLQP0100K*	MSL3	90			
41	R5F523E6LDFP	PLQP0100K*	MSL3	91			
42	R5F523E6LGFP	PLQP0100K*	MSL3	92			
43	R5F523E6NDFP	PLQP0100K*	MSL3	93			
44	R5F523E6NGFP	PLQP0100K*	MSL3	94			
45	R5F523E5BDNF	PWQN0040K*	MSL3	95			
46	R5F523E5BGNF	PWQN0040K*	MSL3	96			
47	R5F523E5KDNF	PWQN0040K*	MSL3	97			
48	R5F523E5KGNF	PWQN0040K*	MSL3	98			
49	R5F523E5MDNF	PWQN0040K*	MSL3	99			
50	R5F523E5MGNF	PWQN0040K*	MSL3	100			

Note: MSL stands for Moisture Sensitivity Level.