

RENESAS SEMICONDUCTOR RELIABILITY REPORT

GROUP : RX651

DEVICE : R5F5651XXX

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	R5F5651CDDBG	PLBG0176G*	MSL3	51	R5F56519FDFB	PLQP0144K*	MSL3
2	R5F5651CDGBG	PLBG0176G*	MSL3	52	R5F56519FGFB	PLQP0144K*	MSL3
3	R5F5651CHDBG	PLBG0176G*	MSL3	53	R5F5651CDDFB	PLQP0144K*	MSL3
4	R5F5651CHGBG	PLBG0176G*	MSL3	54	R5F5651CDGFB	PLQP0144K*	MSL3
5	R5F5651EDDBG	PLBG0176G*	MSL3	55	R5F5651CHDFB	PLQP0144K*	MSL3
6	R5F5651EDGBG	PLBG0176G*	MSL3	56	R5F5651CHGFB	PLQP0144K*	MSL3
7	R5F5651EHDBG	PLBG0176G*	MSL3	57	R5F5651EDDFB	PLQP0144K*	MSL3
8	R5F5651EHGBG	PLBG0176G*	MSL3	58	R5F5651EDGFB	PLQP0144K*	MSL3
9	R5F56514BDBP	PTBG0064K*	MSL3	59	R5F5651EHDFB	PLQP0144K*	MSL3
10	R5F56514BGBP	PTBG0064K*	MSL3	60	R5F5651EHGFB	PLQP0144K*	MSL3
11	R5F56514FDBP	PTBG0064K*	MSL3	61	R5F5651CDDFC	PLQP0176K*	MSL3
12	R5F56514FGBP	PTBG0064K*	MSL3	62	R5F5651CDGFC	PLQP0176K*	MSL3
13	R5F56517BDBP	PTBG0064K*	MSL3	63	R5F5651CHDFC	PLQP0176K*	MSL3
14	R5F56517BGBP	PTBG0064K*	MSL3	64	R5F5651CHGFC	PLQP0176K*	MSL3
15	R5F56517FDBP	PTBG0064K*	MSL3	65	R5F5651EDDFC	PLQP0176K*	MSL3
16	R5F56517FGBP	PTBG0064K*	MSL3	66	R5F5651EDGFC	PLQP0176K*	MSL3
17	R5F56519BDBP	PTBG0064K*	MSL3	67	R5F5651EHDFC	PLQP0176K*	MSL3
18	R5F56519BGBP	PTBG0064K*	MSL3	68	R5F5651EHGFC	PLQP0176K*	MSL3
19	R5F56519FDBP	PTBG0064K*	MSL3	69	R5F56514BDFM	PLQP0064K*	MSL3
20	R5F56519FGBP	PTBG0064K*	MSL3	70	R5F56514BGFM	PLQP0064K*	MSL3
21	R5F5651CDDBP	PTBG0064K*	MSL3	71	R5F56514FDFM	PLQP0064K*	MSL3
22	R5F5651CDGBP	PTBG0064K*	MSL3	72	R5F56514FGFM	PLQP0064K*	MSL3
23	R5F5651CHDBP	PTBG0064K*	MSL3	73	R5F56517BDFM	PLQP0064K*	MSL3
24	R5F5651CHGBP	PTBG0064K*	MSL3	74	R5F56517BGFM	PLQP0064K*	MSL3
25	R5F5651EDDBP	PTBG0064K*	MSL3	75	R5F56517FDFM	PLQP0064K*	MSL3
26	R5F5651EDGBP	PTBG0064K*	MSL3	76	R5F56517FGFM	PLQP0064K*	MSL3
27	R5F5651EHDBP	PTBG0064K*	MSL3	77	R5F56519BDFM	PLQP0064K*	MSL3
28	R5F5651EHGBP	PTBG0064K*	MSL3	78	R5F56519BGFM	PLQP0064K*	MSL3
29	R5F56514ADFB	PLQP0144K*	MSL3	79	R5F56519FDFM	PLQP0064K*	MSL3
30	R5F56514AGFB	PLQP0144K*	MSL3	80	R5F56519FGFM	PLQP0064K*	MSL3
31	R5F56514BDFB	PLQP0144K*	MSL3	81	R5F5651CDDFM	PLQP0064K*	MSL3
32	R5F56514BGFB	PLQP0144K*	MSL3	82	R5F5651CDGFM	PLQP0064K*	MSL3
33	R5F56514EDFB	PLQP0144K*	MSL3	83	R5F5651CHDFM	PLQP0064K*	MSL3
34	R5F56514EGFB	PLQP0144K*	MSL3	84	R5F5651CHGFM	PLQP0064K*	MSL3
35	R5F56514FDFB	PLQP0144K*	MSL3	85	R5F5651EDDFM	PLQP0064K*	MSL3
36	R5F56514FGFB	PLQP0144K*	MSL3	86	R5F5651EDGFM	PLQP0064K*	MSL3
37	R5F56517ADFB	PLQP0144K*	MSL3	87	R5F5651EHDFM	PLQP0064K*	MSL3
38	R5F56517AGFB	PLQP0144K*	MSL3	88	R5F5651EHGFM	PLQP0064K*	MSL3
39	R5F56517BDFB	PLQP0144K*	MSL3	89	R5F56514ADFP	PLQP0100K*	MSL3
40	R5F56517BGFB	PLQP0144K*	MSL3	90	R5F56514AGFP	PLQP0100K*	MSL3
41	R5F56517EDFB	PLQP0144K*	MSL3	91	R5F56514BDFP	PLQP0100K*	MSL3
42	R5F56517EGFB	PLQP0144K*	MSL3	92	R5F56514BGFP	PLQP0100K*	MSL3
43	R5F56517FDFB	PLQP0144K*	MSL3	93	R5F56514EDFP	PLQP0100K*	MSL3
44	R5F56517FGFB	PLQP0144K*	MSL3	94	R5F56514EGFP	PLQP0100K*	MSL3
45	R5F56519ADFB	PLQP0144K*	MSL3	95	R5F56514FDFP	PLQP0100K*	MSL3
46	R5F56519AGFB	PLQP0144K*	MSL3	96	R5F56514FGFP	PLQP0100K*	MSL3
47	R5F56519BDFB	PLQP0144K*	MSL3	97	R5F56517ADFP	PLQP0100K*	MSL3
48	R5F56519BGFB	PLQP0144K*	MSL3	98	R5F56517AGFP	PLQP0100K*	MSL3
49	R5F56519EDFB	PLQP0144K*	MSL3	99	R5F56517BDFP	PLQP0100K*	MSL3
50	R5F56519EGFB	PLQP0144K*	MSL3	100	R5F56517BGFP	PLQP0100K*	MSL3

Note: MSL stands for Moisture Sensitivity Level.

Table. Product list

No	Product part number	Package code	MSL	No	Product part number	Package code	MSL
101	R5F56517EDFP	PLQP0100K*	MSL3	161	R5F56514ADLK	PTLG0145K*	MSL3
102	R5F56517EGFP	PLQP0100K*	MSL3	162	R5F56514AGLK	PTLG0145K*	MSL3
103	R5F56517FDFP	PLQP0100K*	MSL3	163	R5F56514BDLK	PTLG0145K*	MSL3
104	R5F56517FGFP	PLQP0100K*	MSL3	164	R5F56514BGLK	PTLG0145K*	MSL3
105	R5F56519ADFP	PLQP0100K*	MSL3	165	R5F56514EDLK	PTLG0145K*	MSL3
106	R5F56519AGFP	PLQP0100K*	MSL3	166	R5F56514EGLK	PTLG0145K*	MSL3
107	R5F56519BDFP	PLQP0100K*	MSL3	167	R5F56514FDLK	PTLG0145K*	MSL3
108	R5F56519BGFP	PLQP0100K*	MSL3	168	R5F56514FGLK	PTLG0145K*	MSL3
109	R5F56519EDFP	PLQP0100K*	MSL3	169	R5F56517ADLK	PTLG0145K*	MSL3
110	R5F56519EGFP	PLQP0100K*	MSL3	170	R5F56517AGLK	PTLG0145K*	MSL3
111	R5F56519FDFP	PLQP0100K*	MSL3	171	R5F56517BDLK	PTLG0145K*	MSL3
112	R5F56519FGFP	PLQP0100K*	MSL3	172	R5F56517BGLK	PTLG0145K*	MSL3
113	R5F5651CDDFP	PLQP0100K*	MSL3	173	R5F56517EDLK	PTLG0145K*	MSL3
114	R5F5651CDGFP	PLQP0100K*	MSL3	174	R5F56517EGLK	PTLG0145K*	MSL3
115	R5F5651CHDFP	PLQP0100K*	MSL3	175	R5F56517FDLK	PTLG0145K*	MSL3
116	R5F5651CHGFP	PLQP0100K*	MSL3	176	R5F56517FGLK	PTLG0145K*	MSL3
117	R5F5651EDDFP	PLQP0100K*	MSL3	177	R5F56519ADLK	PTLG0145K*	MSL3
118	R5F5651EDGFP	PLQP0100K*	MSL3	178	R5F56519AGLK	PTLG0145K*	MSL3
119	R5F5651EHDFP	PLQP0100K*	MSL3	179	R5F56519BDLK	PTLG0145K*	MSL3
120	R5F5651EHGFP	PLQP0100K*	MSL3	180	R5F56519BGLK	PTLG0145K*	MSL3
121	R5F5651CDDLK	PTLG0177K*	MSL3	181	R5F56519EDLK	PTLG0145K*	MSL3
122	R5F5651CDGLK	PTLG0177K*	MSL3	182	R5F56519EGLK	PTLG0145K*	MSL3
123	R5F5651CHDLK	PTLG0177K*	MSL3	183	R5F56519FDLK	PTLG0145K*	MSL3
124	R5F5651CHGLK	PTLG0177K*	MSL3	184	R5F56519FGLK	PTLG0145K*	MSL3
125	R5F5651EDDLK	PTLG0177K*	MSL3	185	R5F5651CDDLK	PTLG0145K*	MSL3
126	R5F5651EDGLK	PTLG0177K*	MSL3	186	R5F5651CDGLK	PTLG0145K*	MSL3
127	R5F5651EHDLC	PTLG0177K*	MSL3	187	R5F5651CHDLK	PTLG0145K*	MSL3
128	R5F5651EHGLK	PTLG0177K*	MSL3	188	R5F5651CHGLK	PTLG0145K*	MSL3
129	R5F56514ADLJ	PTLG0100J*	MSL3	189	R5F5651EDDLK	PTLG0145K*	MSL3
130	R5F56514AGLJ	PTLG0100J*	MSL3	190	R5F5651EDGLK	PTLG0145K*	MSL3
131	R5F56514BDLJ	PTLG0100J*	MSL3	191	R5F5651EHDLC	PTLG0145K*	MSL3
132	R5F56514BGLJ	PTLG0100J*	MSL3	192	R5F5651EHGLK	PTLG0145K*	MSL3
133	R5F56514EDLJ	PTLG0100J*	MSL3	193			
134	R5F56514EGLJ	PTLG0100J*	MSL3	194			
135	R5F56514FDLJ	PTLG0100J*	MSL3	195			
136	R5F56514FGLJ	PTLG0100J*	MSL3	196			
137	R5F56517ADLJ	PTLG0100J*	MSL3	197			
138	R5F56517AGLJ	PTLG0100J*	MSL3	198			
139	R5F56517BDLJ	PTLG0100J*	MSL3	199			
140	R5F56517BGLJ	PTLG0100J*	MSL3	200			
141	R5F56517EDLJ	PTLG0100J*	MSL3	201			
142	R5F56517EGLJ	PTLG0100J*	MSL3	202			
143	R5F56517FDLJ	PTLG0100J*	MSL3	203			
144	R5F56517FGLJ	PTLG0100J*	MSL3	204			
145	R5F56519ADLJ	PTLG0100J*	MSL3	205			
146	R5F56519AGLJ	PTLG0100J*	MSL3	206			
147	R5F56519BDLJ	PTLG0100J*	MSL3	207			
148	R5F56519BGLJ	PTLG0100J*	MSL3	208			
149	R5F56519EDLJ	PTLG0100J*	MSL3	209			
150	R5F56519EGLJ	PTLG0100J*	MSL3	210			
151	R5F56519FDLJ	PTLG0100J*	MSL3	211			
152	R5F56519FGLJ	PTLG0100J*	MSL3	212			
153	R5F5651CDDLJ	PTLG0100J*	MSL3	213			
154	R5F5651CDGLJ	PTLG0100J*	MSL3	214			
155	R5F5651CHDLJ	PTLG0100J*	MSL3	215			
156	R5F5651CHGLJ	PTLG0100J*	MSL3	216			
157	R5F5651EDDLJ	PTLG0100J*	MSL3	217			
158	R5F5651EDGLJ	PTLG0100J*	MSL3	218			
159	R5F5651EHDLJ	PTLG0100J*	MSL3	219			
160	R5F5651EHGLJ	PTLG0100J*	MSL3	220			

Note: MSL stands for Moisture Sensitivity Level.