

RENESAS SEMICONDUCTOR RELIABILITY REPORT

GROUP : RX651
DEVICE : R5F5651XXX
APPLICATION : Consumer / Industry

Quality Assurance Div.
Renesas Electronics Corporation

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Table. Reliability test results (QFP)

Test Items	Reference	Test Conditions	Results Failure/Size	Comment
High Temperature Operating Life (HTOL)	JESD22-A108	Ta=125 °C, Vccmax, 1000 hrs	0/22	
High Temperature Storage Life (HTSL)	JESD22-A103	Ta=150 °C, 1000 hrs	0/22	
Temperature Humidity bias (THB) (*1)	JESD22-A101	Ta=85 °C, RH=85 %, Vccmax, 1000 hrs	0/22	
Temperature Cycling (TC) (*1)	JESD22-A104	Ta=-65 °C to 150 °C , 300 cycles	0/22	
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	+/-500V,1time	0/3	Class: C2
Solderability (SD)	J-STD-002	245 °C, 5 s, Solder coverage ≥95 %	0/5	
Resistance to Soldering Heat (PC)	JESD22-A113, J-STD-020	MSL3(Moisture Sensitivity Level 3)	0/22	

*1) With preconditioning per JESD22-A113, MSL 3

•It is tested to confirm that all the samples are satisfied with an individual product specification.

Note :

Basically qualification tests were performed using a representative product with the same wafer process and the same package structure .

Table. Reliability test results (BGA)

Test Items	Reference	Test Conditions	Results Failure/Size	Comment
High Temperature Operating Life (HTOL)	JESD22-A108	Ta=125 °C, Vccmax, 1000 hrs	0/22	
High Temperature Storage Life (HTSL)	JESD22-A103	Ta=150 °C, 1000 hrs	0/22	
Temperature Humidity bias (THB) (*1)	JESD22-A101	Ta=85 °C, RH=85 %, Vccmax, 1000 hrs	0/22	
Temperature Cycling (TC) (*1)	JESD22-A104	Ta=-55 °C to 125 °C , 500 cycles	0/22	
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	+/-500V,1time	0/3	Class: C2
Resistance to Soldering Heat (PC)	JESD22-A113, J-STD-020	MSL3(Moisture Sensitivity Level 3)	0/22	

*1) With preconditioning per JESD22-A113, MSL 3

•It is tested to confirm that all the samples are satisfied with an individual product specification.

Note :

Basically qualification tests were performed using a representative product with the same wafer process and the same package structure .

Table. Reliability test results (LGA)

Test Items	Reference	Test Conditions	Results Failure/Size	Comment
High Temperature Operating Life (HTOL)	JESD22-A108	Ta=125 °C, Vccmax, 1000 hrs	0/22	
High Temperature Storage Life (HTSL)	JESD22-A103	Ta=150 °C, 1000 hrs	0/22	
Temperature Humidity bias (THB) (*1)	JESD22-A101	Ta=85 °C, RH=85 %, Vccmax, 1000 hrs	0/22	
Temperature Cycling (TC) (*1)	JESD22-A104	Ta=-55 °C to 125 °C , 500 cycles	0/22	
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	+/-500V,1time	0/3	Class: C2
Resistance to Soldering Heat (PC)	JESD22-A113, J-STD-020	MSL3(Moisture Sensitivity Level 3)	0/22	

*1) With preconditioning per JESD22-A113, MSL 3

•It is tested to confirm that all the samples are satisfied with an individual product specification.

Note :

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 (λ_b)

$$\lambda_b = 0.08 \text{ FIT}$$

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
Non-lead type plastic package	QFN	PxQN
Grid array type plastic package	BGA	PxBG
	LGA	PxLG

*1. First four digit

Table. Product list

No	Group	Product part number	Package code	No	Group	Product part number	Package code
1	RX651	R5F5651CDDBG	PLBG0176G*	51	RX651	R5F56519FDFB	PLQP0144K*
2	RX651	R5F5651CDGBG	PLBG0176G*	52	RX651	R5F56519FGFB	PLQP0144K*
3	RX651	R5F5651CHDBG	PLBG0176G*	53	RX651	R5F5651CDDFB	PLQP0144K*
4	RX651	R5F5651CHGBG	PLBG0176G*	54	RX651	R5F5651CDGFB	PLQP0144K*
5	RX651	R5F5651EDDBG	PLBG0176G*	55	RX651	R5F5651CHDFB	PLQP0144K*
6	RX651	R5F5651EDGBG	PLBG0176G*	56	RX651	R5F5651CHGFB	PLQP0144K*
7	RX651	R5F5651EHDBG	PLBG0176G*	57	RX651	R5F5651EDDFB	PLQP0144K*
8	RX651	R5F5651EHGBG	PLBG0176G*	58	RX651	R5F5651EDGFB	PLQP0144K*
9	RX651	R5F56514BDBP	PTBG0064K*	59	RX651	R5F5651EHDFB	PLQP0144K*
10	RX651	R5F56514BGBP	PTBG0064K*	60	RX651	R5F5651EHGFB	PLQP0144K*
11	RX651	R5F56514FDBP	PTBG0064K*	61	RX651	R5F5651CDDFC	PLQP0176K*
12	RX651	R5F56514FGBP	PTBG0064K*	62	RX651	R5F5651CDGFC	PLQP0176K*
13	RX651	R5F56517BDBP	PTBG0064K*	63	RX651	R5F5651CHDFC	PLQP0176K*
14	RX651	R5F56517BGBP	PTBG0064K*	64	RX651	R5F5651CHGFC	PLQP0176K*
15	RX651	R5F56517FDBP	PTBG0064K*	65	RX651	R5F5651EDDFC	PLQP0176K*
16	RX651	R5F56517FGBP	PTBG0064K*	66	RX651	R5F5651EDGFC	PLQP0176K*
17	RX651	R5F56519BDBP	PTBG0064K*	67	RX651	R5F5651EHDFC	PLQP0176K*
18	RX651	R5F56519BGBP	PTBG0064K*	68	RX651	R5F5651EHGFC	PLQP0176K*
19	RX651	R5F56519FDBP	PTBG0064K*	69	RX651	R5F56514BDFM	PLQP0064K*
20	RX651	R5F56519FGBP	PTBG0064K*	70	RX651	R5F56514BGFM	PLQP0064K*
21	RX651	R5F5651CDDBP	PTBG0064K*	71	RX651	R5F56514FDFM	PLQP0064K*
22	RX651	R5F5651CDGBP	PTBG0064K*	72	RX651	R5F56514FGFM	PLQP0064K*
23	RX651	R5F5651CHDBP	PTBG0064K*	73	RX651	R5F56517BDFM	PLQP0064K*
24	RX651	R5F5651CHGBP	PTBG0064K*	74	RX651	R5F56517BGFM	PLQP0064K*
25	RX651	R5F5651EDDBP	PTBG0064K*	75	RX651	R5F56517FDFM	PLQP0064K*
26	RX651	R5F5651EDGBP	PTBG0064K*	76	RX651	R5F56517FGFM	PLQP0064K*
27	RX651	R5F5651EHDBP	PTBG0064K*	77	RX651	R5F56519BDFM	PLQP0064K*
28	RX651	R5F5651EHGBP	PTBG0064K*	78	RX651	R5F56519BGFM	PLQP0064K*
29	RX651	R5F56514ADFB	PLQP0144K*	79	RX651	R5F56519FDFM	PLQP0064K*
30	RX651	R5F56514AGFB	PLQP0144K*	80	RX651	R5F56519FGFM	PLQP0064K*
31	RX651	R5F56514BDFB	PLQP0144K*	81	RX651	R5F5651CDDFM	PLQP0064K*
32	RX651	R5F56514BGFB	PLQP0144K*	82	RX651	R5F5651CDGFM	PLQP0064K*
33	RX651	R5F56514EDFB	PLQP0144K*	83	RX651	R5F5651CHDFM	PLQP0064K*
34	RX651	R5F56514EGFB	PLQP0144K*	84	RX651	R5F5651CHGFM	PLQP0064K*
35	RX651	R5F56514FDFB	PLQP0144K*	85	RX651	R5F5651EDDFM	PLQP0064K*
36	RX651	R5F56514FGFB	PLQP0144K*	86	RX651	R5F5651EDGFM	PLQP0064K*
37	RX651	R5F56517ADFB	PLQP0144K*	87	RX651	R5F5651EHDFM	PLQP0064K*
38	RX651	R5F56517AGFB	PLQP0144K*	88	RX651	R5F5651EHGFM	PLQP0064K*
39	RX651	R5F56517BDFB	PLQP0144K*	89	RX651	R5F56514ADFP	PLQP0100K*
40	RX651	R5F56517BGFB	PLQP0144K*	90	RX651	R5F56514AGFP	PLQP0100K*
41	RX651	R5F56517EDFB	PLQP0144K*	91	RX651	R5F56514BDFP	PLQP0100K*
42	RX651	R5F56517EGFB	PLQP0144K*	92	RX651	R5F56514BGFP	PLQP0100K*
43	RX651	R5F56517FDFB	PLQP0144K*	93	RX651	R5F56514EDFP	PLQP0100K*
44	RX651	R5F56517FGFB	PLQP0144K*	94	RX651	R5F56514EGFP	PLQP0100K*
45	RX651	R5F56519ADFB	PLQP0144K*	95	RX651	R5F56514FDFP	PLQP0100K*
46	RX651	R5F56519AGFB	PLQP0144K*	96	RX651	R5F56514FGFP	PLQP0100K*
47	RX651	R5F56519BDFB	PLQP0144K*	97	RX651	R5F56517ADFP	PLQP0100K*
48	RX651	R5F56519BGFB	PLQP0144K*	98	RX651	R5F56517AGFP	PLQP0100K*
49	RX651	R5F56519EDFB	PLQP0144K*	99	RX651	R5F56517BDFP	PLQP0100K*
50	RX651	R5F56519EGFB	PLQP0144K*	100	RX651	R5F56517BGFP	PLQP0100K*

Table. Product list

MCR-22-0316

No	Group	Product part number	Package code	No	Group	Product part number	Package code
101	RX651	R5F56517EDFP	PLQP0100K*	161	RX651	R5F56514ADLK	PTLG0145K*
102	RX651	R5F56517EGFP	PLQP0100K*	162	RX651	R5F56514AGLK	PTLG0145K*
103	RX651	R5F56517FDFP	PLQP0100K*	163	RX651	R5F56514BDLK	PTLG0145K*
104	RX651	R5F56517FGFP	PLQP0100K*	164	RX651	R5F56514BGLK	PTLG0145K*
105	RX651	R5F56519ADFP	PLQP0100K*	165	RX651	R5F56514EDLK	PTLG0145K*
106	RX651	R5F56519AGFP	PLQP0100K*	166	RX651	R5F56514EGLK	PTLG0145K*
107	RX651	R5F56519BDFP	PLQP0100K*	167	RX651	R5F56514FDLK	PTLG0145K*
108	RX651	R5F56519BGFP	PLQP0100K*	168	RX651	R5F56514FGLK	PTLG0145K*
109	RX651	R5F56519EDFP	PLQP0100K*	169	RX651	R5F56517ADLK	PTLG0145K*
110	RX651	R5F56519EGFP	PLQP0100K*	170	RX651	R5F56517AGLK	PTLG0145K*
111	RX651	R5F56519FDFP	PLQP0100K*	171	RX651	R5F56517BDLK	PTLG0145K*
112	RX651	R5F56519FGFP	PLQP0100K*	172	RX651	R5F56517BGLK	PTLG0145K*
113	RX651	R5F5651CDDFP	PLQP0100K*	173	RX651	R5F56517EDLK	PTLG0145K*
114	RX651	R5F5651CDGFP	PLQP0100K*	174	RX651	R5F56517EGLK	PTLG0145K*
115	RX651	R5F5651CHDFP	PLQP0100K*	175	RX651	R5F56517FDLK	PTLG0145K*
116	RX651	R5F5651CHGFP	PLQP0100K*	176	RX651	R5F56517FGLK	PTLG0145K*
117	RX651	R5F5651EDDFP	PLQP0100K*	177	RX651	R5F56519ADLK	PTLG0145K*
118	RX651	R5F5651EDGFP	PLQP0100K*	178	RX651	R5F56519AGLK	PTLG0145K*
119	RX651	R5F5651EHDFP	PLQP0100K*	179	RX651	R5F56519BDLK	PTLG0145K*
120	RX651	R5F5651EHGFP	PLQP0100K*	180	RX651	R5F56519BGLK	PTLG0145K*
121	RX651	R5F5651CDDLK	PTLG0177K*	181	RX651	R5F56519EDLK	PTLG0145K*
122	RX651	R5F5651CDGLK	PTLG0177K*	182	RX651	R5F56519EGLK	PTLG0145K*
123	RX651	R5F5651CHDLK	PTLG0177K*	183	RX651	R5F56519FDLK	PTLG0145K*
124	RX651	R5F5651CHGLK	PTLG0177K*	184	RX651	R5F56519FGLK	PTLG0145K*
125	RX651	R5F5651EDDLK	PTLG0177K*	185	RX651	R5F5651CDDLK	PTLG0145K*
126	RX651	R5F5651EDGLK	PTLG0177K*	186	RX651	R5F5651CDGLK	PTLG0145K*
127	RX651	R5F5651EHDLC	PTLG0177K*	187	RX651	R5F5651CHDLK	PTLG0145K*
128	RX651	R5F5651EHGLK	PTLG0177K*	188	RX651	R5F5651CHGLK	PTLG0145K*
129	RX651	R5F56514ADLJ	PTLG0100J*	189	RX651	R5F5651EDDLK	PTLG0145K*
130	RX651	R5F56514AGLJ	PTLG0100J*	190	RX651	R5F5651EDGLK	PTLG0145K*
131	RX651	R5F56514BDLJ	PTLG0100J*	191	RX651	R5F5651EHDLC	PTLG0145K*
132	RX651	R5F56514BGLJ	PTLG0100J*	192	RX651	R5F5651EHGLK	PTLG0145K*
133	RX651	R5F56514EDLJ	PTLG0100J*	193			
134	RX651	R5F56514EGLJ	PTLG0100J*	194			
135	RX651	R5F56514FDLJ	PTLG0100J*	195			
136	RX651	R5F56514FGLJ	PTLG0100J*	196			
137	RX651	R5F56517ADLJ	PTLG0100J*	197			
138	RX651	R5F56517AGLJ	PTLG0100J*	198			
139	RX651	R5F56517BDLJ	PTLG0100J*	199			
140	RX651	R5F56517BGLJ	PTLG0100J*	200			
141	RX651	R5F56517EDLJ	PTLG0100J*	201			
142	RX651	R5F56517EGLJ	PTLG0100J*	202			
143	RX651	R5F56517FDLJ	PTLG0100J*	203			
144	RX651	R5F56517FGLJ	PTLG0100J*	204			
145	RX651	R5F56519ADLJ	PTLG0100J*	205			
146	RX651	R5F56519AGLJ	PTLG0100J*	206			
147	RX651	R5F56519BDLJ	PTLG0100J*	207			
148	RX651	R5F56519BGLJ	PTLG0100J*	208			
149	RX651	R5F56519EDLJ	PTLG0100J*	209			
150	RX651	R5F56519EGLJ	PTLG0100J*	210			
151	RX651	R5F56519FDLJ	PTLG0100J*	211			
152	RX651	R5F56519FGLJ	PTLG0100J*	212			
153	RX651	R5F5651CDDLJ	PTLG0100J*	213			
154	RX651	R5F5651CDGLJ	PTLG0100J*	214			
155	RX651	R5F5651CHDLJ	PTLG0100J*	215			
156	RX651	R5F5651CHGLJ	PTLG0100J*	216			
157	RX651	R5F5651EDDLJ	PTLG0100J*	217			
158	RX651	R5F5651EDGLJ	PTLG0100J*	218			
159	RX651	R5F5651EHDLJ	PTLG0100J*	219			
160	RX651	R5F5651EHGLJ	PTLG0100J*	220			