Report No. MCR-22-0316
April 26,2022

RENESAS SEMICONDUCTOR RELIABILITY REPORT

GROUP : RX651

DEVICE : R5F5651XXX

APPLICATION : Consumer / Industry

Quality Assurance Div.
Renesas Electronics Corporation

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(Rev.5.0-2 October 2020)

Table. Reliability test results (QFP)

Test Items	Reference	Test Conditions	Results Failure/Size	Comment
High Temperature Operating Life (HTOL)	JESD22-A108	Ta=125 ℃, Vccmax, 1000 hrs	0/22	
High Temperature Storage Life (HTSL)	JESD22-A103	Ta=150 ℃, 1000 hrs	0/22	
Temperature Humidity bias (THB) (*1)	JESD22-A101	Ta=85 ℃, RH=85 %, Vccmax, 1000 hrs	0/22	
Temperature Cycling (TC) (*1)	JESD22-A104	Ta=-65 ℃ to 150 ℃ , 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 ℃, 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 ℃, Vccmax, 1000 hrs	0/22	
High Temperature Storage Life (HTSL)	JESD22-A103	Ta=150 ℃, 1000 hrs	0/22	
Temperature Humidity bias (THB) (*1)	JESD22-A101	Ta=85 ℃, RH=85 %, Vccmax, 1000 hrs	0/22	
Temperature Cycling (TC) (*1)	JESD22-A104	Ta=-55 ℃ to 125 ℃ , 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 ℃, Vccmax, 1000 hrs	0/22	
High Temperature Storage Life (HTSL)	JESD22-A103	Ta=150 ℃, 1000 hrs	0/22	
Temperature Humidity bias (THB) (*1)	JESD22-A101	Ta=85 ℃, RH=85 %, Vccmax, 1000 hrs	0/22	
Temperature Cycling (TC) (*1)	JESD22-A104	Ta=-55 ℃ to 125 ℃ , 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)

$$\lambda = \lambda b \times \pi T \quad (FIT)$$

①Unique failure rate (λb)

λb= 0.08 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
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
1	RX651	R5F5651CDDBG	PLBG0176G*
2	RX651	R5F5651CDGBG	PLBG0176G*
3	RX651	R5F5651CHDBG	PLBG0176G*
4	RX651	R5F5651CHGBG	PLBG0176G*
5	RX651	R5F5651EDDBG	PLBG0176G*
6	RX651	R5F5651EDGBG	PLBG0176G*
7	RX651	R5F5651EHDBG	PLBG0176G*
8	RX651	R5F5651EHGBG	PLBG0176G*
9	RX651	R5F56514BDBP	PTBG0064K*
10	RX651	R5F56514BGBP	PTBG0064K*
11	RX651	R5F56514FDBP	PTBG0064K*
12	RX651	R5F56514FGBP	PTBG0064K*
13	RX651	R5F56517BDBP	PTBG0064K*
14	RX651	R5F56517BGBP	PTBG0064K*
15	RX651	R5F56517FDBP	PTBG0064K*
16	RX651	R5F56517FGBP	PTBG0064K*
17	RX651	R5F56519BDBP	PTBG0064K*
18	RX651	R5F56519BGBP	PTBG0064K*
19	RX651	R5F56519FDBP	PTBG0064K*
20	RX651	R5F56519FGBP	PTBG0064K*
21	RX651	R5F5651CDDBP	PTBG0064K*
22	RX651	R5F5651CDGBP	PTBG0064K*
23	RX651	R5F5651CHDBP	PTBG0064K*
24	RX651	R5F5651CHGBP	PTBG0064K*
25	RX651	R5F5651EDDBP	PTBG0064K*
26	RX651	R5F5651EDGBP	PTBG0064K*
27	RX651	R5F5651EHDBP	PTBG0064K*
28	RX651	R5F5651EHGBP	PTBG0064K*
29	RX651	R5F56514ADFB	PLQP0144K*
30	RX651	R5F56514AGFB	PLQP0144K*
31	RX651	R5F56514BDFB	PLQP0144K*
32	RX651	R5F56514BGFB	PLQP0144K*
33	RX651	R5F56514EDFB	PLQP0144K*
34	RX651	R5F56514EGFB	PLQP0144K*
35	RX651	R5F56514FDFB	PLQP0144K*
36	RX651	R5F56514FGFB	PLQP0144K*
37	RX651	R5F56517ADFB	PLQP0144K*
38	RX651	R5F56517AGFB	PLQP0144K*
39	RX651	R5F56517BDFB	PLQP0144K*
40	RX651	R5F56517BGFB	PLQP0144K*
41	RX651	R5F56517EDFB	PLQP0144K*
42	RX651	R5F56517EGFB	PLQP0144K*
43	RX651	R5F56517FDFB	PLQP0144K*
44	RX651	R5F56517FGFB	PLQP0144K*
45	RX651	R5F56519ADFB	PLQP0144K*
46	RX651	R5F56519AGFB	PLQP0144K*
47	RX651	R5F56519BDFB	PLQP0144K*
48	RX651	R5F56519BGFB	PLQP0144K*
49	RX651	R5F56519EDFB	PLQP0144K*
50	RX651	R5F56519EGFB	PLQP0144K*
51	RX651	R5F56519FDFB	PLQP0144K*
52	RX651	R5F56519FGFB	PLQP0144K*
53	RX651	R5F5651CDDFB	PLQP0144K*
54	RX651	R5F5651CDGFB	PLQP0144K*
55	RX651	R5F5651CHDFB	PLQP0144K*
56	RX651	R5F5651CHGFB	PLQP0144K*
57	RX651	R5F5651EDDFB	PLQP0144K*
58	RX651	R5F5651EDGFB	PLQP0144K*
59	RX651	R5F5651EHDFB	PLQP0144K*
60	RX651	R5F5651EHGFB	PLQP0144K*
61	RX651	R5F5651CDDFC	PLQP0176K*
62	RX651	R5F5651CDGFC	PLQP0176K*
63	RX651	R5F5651CHDFC	PLQP0176K*
64	RX651	R5F5651CHGFC	PLQP0176K*
65	RX651	R5F5651EDDFC	PLQP0176K*
66	RX651	R5F5651EDGFC	PLQP0176K*
67	RX651	R5F5651EHDFC	PLQP0176K*
68	RX651	R5F5651EHGFC	PLQP0176K*
69	RX651	R5F56514BDFM	PLQP0064K*
70	RX651	R5F56514BGFM	PLQP0064K*
71	RX651	R5F56514FDFM	PLQP0064K*
72	RX651	R5F56514FGFM	PLQP0064K*
73	RX651	R5F56517BDFM	PLQP0064K*
74	RX651	R5F56517BGFM	PLQP0064K*
75	RX651	R5F56517FDFM	PLQP0064K*
76	RX651	R5F56517FGFM	PLQP0064K*
77	RX651	R5F56519BDFM	PLQP0064K*
78	RX651	R5F56519BGFM	PLQP0064K*
79	RX651	R5F56519FDFM	PLQP0064K*
80	RX651	R5F56519FGFM	PLQP0064K*
81	RX651	R5F5651CDDFM	PLQP0064K*
82	RX651	R5F5651CDGFM	PLQP0064K*
83	RX651	R5F5651CHDFM	PLQP0064K*
84	RX651	R5F5651CHGFM	PLQP0064K*
85	RX651	R5F5651EDDFM	PLQP0064K*
86	RX651	R5F5651EDGFM	PLQP0064K*
87	RX651	R5F5651EHDFM	PLQP0064K*
88	RX651	R5F5651EHGFM	PLQP0064K*
89	RX651	R5F56514ADFP	PLQP0100K*
90	RX651	R5F56514AGFP	PLQP0100K*
91	RX651	R5F56514BDFP	PLQP0100K*
92	RX651	R5F56514BGFP	PLQP0100K*
93	RX651	R5F56514EDFP	PLQP0100K*
94	RX651	R5F56514EGFP	PLQP0100K*
95	RX651	R5F56514FDFP	PLQP0100K*
96	RX651	R5F56514FGFP	PLQP0100K*
97	RX651	R5F56517ADFP	PLQP0100K*
98	RX651	R5F56517AGFP	PLQP0100K*
99	RX651	R5F56517BDFP	PLQP0100K*
100	RX651	R5F56517BGFP	PLQP0100K*

Table. Product list

No	Group	Product part number	Package code
101	RX651	R5F56517EDFP	PLQP0100K*
102	RX651	R5F56517EGFP	PLQP0100K*
103	RX651	R5F56517FDFP	PLQP0100K*
104	RX651	R5F56517FGFP	PLQP0100K*
105	RX651	R5F56519ADFP	PLQP0100K*
106	RX651	R5F56519AGFP	PLQP0100K*
107	RX651	R5F56519BDFP	PLQP0100K*
108	RX651	R5F56519BGFP	PLQP0100K*
109	RX651	R5F56519EDFP	PLQP0100K*
110	RX651	R5F56519EGFP	PLQP0100K*
111	RX651	R5F56519FDFP	PLQP0100K*
112	RX651	R5F56519FGFP	PLQP0100K*
113	RX651	R5F5651CDDFP	PLQP0100K*
114	RX651	R5F5651CDGFP	PLQP0100K*
115	RX651	R5F5651CHDFP	PLQP0100K*
116	RX651	R5F5651CHGFP	PLQP0100K*
117	RX651	R5F5651EDDFP	PLQP0100K*
118	RX651	R5F5651EDGFP	PLQP0100K*
119	RX651	R5F5651EHDFP	PLQP0100K*
120	RX651	R5F5651EHGFP	PLQP0100K*
121	RX651	R5F5651CDDLC	PTLG0177K*
122	RX651	R5F5651CDGLC	PTLG0177K*
123	RX651	R5F5651CHDLC	PTLG0177K*
124	RX651	R5F5651CHGLC	PTLG0177K*
125	RX651	R5F5651EDDLC	PTLG0177K*
126	RX651	R5F5651EDGLC	PTLG0177K*
127	RX651	R5F5651EHDLC	PTLG0177K*
128	RX651	R5F5651EHGLC	PTLG0177K*
129	RX651	R5F56514ADLJ	PTLG0100J*
130	RX651	R5F56514AGLJ	PTLG0100J*
131	RX651	R5F56514BDLJ	PTLG0100J*
132	RX651	R5F56514BGLJ	PTLG0100J*
133	RX651	R5F56514EDLJ	PTLG0100J*
134	RX651	R5F56514EGLJ	PTLG0100J*
135	RX651	R5F56514FDLJ	PTLG0100J*
136	RX651	R5F56514FGLJ	PTLG0100J*
137	RX651	R5F56517ADLJ	PTLG0100J*
138	RX651	R5F56517AGLJ	PTLG0100J*
139	RX651	R5F56517BDLJ	PTLG0100J*
140	RX651	R5F56517BGLJ	PTLG0100J*
141	RX651	R5F56517EDLJ	PTLG0100J*
142	RX651	R5F56517EGLJ	PTLG0100J*
143	RX651	R5F56517FDLJ	PTLG0100J*
144	RX651	R5F56517FGLJ	PTLG0100J*
145	RX651	R5F56519ADLJ	PTLG0100J*
146	RX651	R5F56519AGLJ	PTLG0100J*
147	RX651	R5F56519BDLJ	PTLG0100J*
148	RX651	R5F56519BGLJ	PTLG0100J*
149	RX651	R5F56519EDLJ	PTLG0100J*
150	RX651	R5F56519EGLJ	PTLG0100J*
151	RX651	R5F56519FDLJ	PTLG0100J*
152	RX651	R5F56519FGLJ	PTLG0100J*
153	RX651	R5F5651CDDLJ	PTLG0100J*
154	RX651	R5F5651CDGLJ	PTLG0100J*
155	RX651	R5F5651CHDLJ	PTLG0100J*
156	RX651	R5F5651CHGLJ	PTLG0100J*
157	RX651	R5F5651EDDLJ	PTLG0100J*
158	RX651	R5F5651EDGLJ	PTLG0100J*
159	RX651	R5F5651EHDLJ	PTLG0100J*
160	RX651	R5F5651EHGLJ	PTLG0100J*

No	Group	Product part number	Package code
161	RX651	R5F56514ADLK	PTLG0145K*
162	RX651	R5F56514AGLK	PTLG0145K*
163	RX651	R5F56514BDLK	PTLG0145K*
164	RX651	R5F56514BGLK	PTLG0145K*
165	RX651	R5F56514EDLK	PTLG0145K*
166	RX651	R5F56514EGLK	PTLG0145K*
167	RX651	R5F56514FDLK	PTLG0145K*
168	RX651	R5F56514FGLK	PTLG0145K*
169	RX651	R5F56517ADLK	PTLG0145K*
170	RX651	R5F56517AGLK	PTLG0145K*
171	RX651	R5F56517BDLK	PTLG0145K*
172	RX651	R5F56517BGLK	PTLG0145K*
173	RX651	R5F56517EDLK	PTLG0145K*
174	RX651	R5F56517EGLK	PTLG0145K*
175	RX651	R5F56517FDLK	PTLG0145K*
176	RX651	R5F56517FGLK	PTLG0145K*
177	RX651	R5F56519ADLK	PTLG0145K*
178	RX651	R5F56519AGLK	PTLG0145K*
179	RX651	R5F56519BDLK	PTLG0145K*
180	RX651	R5F56519BGLK	PTLG0145K*
181	RX651	R5F56519EDLK	PTLG0145K*
182	RX651	R5F56519EGLK	PTLG0145K*
183	RX651	R5F56519FDLK	PTLG0145K*
184	RX651	R5F56519FGLK	PTLG0145K*
185	RX651	R5F5651CDDLK	PTLG0145K*
186	RX651	R5F5651CDGLK	PTLG0145K*
187	RX651	R5F5651CHDLK	PTLG0145K*
188	RX651	R5F5651CHGLK	PTLG0145K*
189	RX651	R5F5651EDDLK	PTLG0145K*
190	RX651	R5F5651EDGLK	PTLG0145K*
191	RX651	R5F5651EHDLK	PTLG0145K*
192	RX651	R5F5651EHGLK	PTLG0145K*
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