

RENESAS SEMICONDUCTOR RELIABILITY REPORT

GROUP : RX631

DEVICE : R5F5631XXX

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 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)	JEITA ED-4701/302	+/-1000 V,1 time	0/3	Class: Equivalent to C2b
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	0/75	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)	JEITA ED-4701/302	+/-1000 V, 1 time	0/3	Class: Equivalent to C2b
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	0/75	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)	JEITA ED-4701/302	+/-1000 V, 1 time	0/3	Class: Equivalent to C2b
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)

$\lambda b= 0.006 \text{ FIT}$

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	R5F56316CDBG	PLBG0176G*	MSL3	51	R5F5631JDGFB	PLQP0144K*	MSL3
2	R5F56316DDBG	PLBG0176G*	MSL3	52	R5F5631KDDFB	PLQP0144K*	MSL3
3	R5F56316SDBG	PLBG0176G*	MSL3	53	R5F5631KDGF	PLQP0144K*	MSL3
4	R5F56317CDBG	PLBG0176G*	MSL3	54	R5F5631WDDFB	PLQP0144K*	MSL3
5	R5F56317DDBG	PLBG0176G*	MSL3	55	R5F5631WDGFB	PLQP0144K*	MSL3
6	R5F56317SDBG	PLBG0176G*	MSL3	56	R5F5631WHDFB	PLQP0144K*	MSL3
7	R5F56318CDBG	PLBG0176G*	MSL3	57	R5F5631YDDFB	PLQP0144K*	MSL3
8	R5F56318DDBG	PLBG0176G*	MSL3	58	R5F5631YDGF	PLQP0144K*	MSL3
9	R5F56318SDBG	PLBG0176G*	MSL3	59	R5F5631YHDFB	PLQP0144K*	MSL3
10	R5F5631ACDBG	PLBG0176G*	MSL3	60	R5F56316CDFC	PLQP0176K*	MSL3
11	R5F5631ADDBG	PLBG0176G*	MSL3	61	R5F56316DDFC	PLQP0176K*	MSL3
12	R5F5631BCDBG	PLBG0176G*	MSL3	62	R5F56316DGFC	PLQP0176K*	MSL3
13	R5F5631BDDBG	PLBG0176G*	MSL3	63	R5F56316SDFC	PLQP0176K*	MSL3
14	R5F5631DCDBG	PLBG0176G*	MSL3	64	R5F56316SGFC	PLQP0176K*	MSL3
15	R5F5631DDDBG	PLBG0176G*	MSL3	65	R5F56317CDFC	PLQP0176K*	MSL3
16	R5F5631ECDBG	PLBG0176G*	MSL3	66	R5F56317DDFC	PLQP0176K*	MSL3
17	R5F5631EDDBG	PLBG0176G*	MSL3	67	R5F56317DGFC	PLQP0176K*	MSL3
18	R5F56316CDFB	PLQP0144K*	MSL3	68	R5F56317SDFC	PLQP0176K*	MSL3
19	R5F56316DDFB	PLQP0144K*	MSL3	69	R5F56317SGFC	PLQP0176K*	MSL3
20	R5F56316DGFB	PLQP0144K*	MSL3	70	R5F56318CDFC	PLQP0176K*	MSL3
21	R5F56316SDFB	PLQP0144K*	MSL3	71	R5F56318DDFC	PLQP0176K*	MSL3
22	R5F56316SGFB	PLQP0144K*	MSL3	72	R5F56318DGFC	PLQP0176K*	MSL3
23	R5F56317CDFB	PLQP0144K*	MSL3	73	R5F56318SDFC	PLQP0176K*	MSL3
24	R5F56317DDFB	PLQP0144K*	MSL3	74	R5F56318SGFC	PLQP0176K*	MSL3
25	R5F56317DGFB	PLQP0144K*	MSL3	75	R5F5631ACDFC	PLQP0176K*	MSL3
26	R5F56317SDFB	PLQP0144K*	MSL3	76	R5F5631ADDFC	PLQP0176K*	MSL3
27	R5F56317SGFB	PLQP0144K*	MSL3	77	R5F5631ADGFC	PLQP0176K*	MSL3
28	R5F56318CDFB	PLQP0144K*	MSL3	78	R5F5631BCDFC	PLQP0176K*	MSL3
29	R5F56318DDFB	PLQP0144K*	MSL3	79	R5F5631BDDFC	PLQP0176K*	MSL3
30	R5F56318DGFB	PLQP0144K*	MSL3	80	R5F5631BDGFC	PLQP0176K*	MSL3
31	R5F56318SDFB	PLQP0144K*	MSL3	81	R5F5631DCDFC	PLQP0176K*	MSL3
32	R5F56318SGFB	PLQP0144K*	MSL3	82	R5F5631DDDFC	PLQP0176K*	MSL3
33	R5F5631ACDFB	PLQP0144K*	MSL3	83	R5F5631DDGFC	PLQP0176K*	MSL3
34	R5F5631ADDFB	PLQP0144K*	MSL3	84	R5F5631ECDFC	PLQP0176K*	MSL3
35	R5F5631ADGFB	PLQP0144K*	MSL3	85	R5F5631EDDFC	PLQP0176K*	MSL3
36	R5F5631BCDFB	PLQP0144K*	MSL3	86	R5F5631EDGFC	PLQP0176K*	MSL3
37	R5F5631BDDFB	PLQP0144K*	MSL3	87	R5F5631FDDFC	PLQP0176K*	MSL3
38	R5F5631BDGFB	PLQP0144K*	MSL3	88	R5F5631FDGFC	PLQP0176K*	MSL3
39	R5F5631DCDFB	PLQP0144K*	MSL3	89	R5F5631FHDFC	PLQP0176K*	MSL3
40	R5F5631DDDFB	PLQP0144K*	MSL3	90	R5F5631KDDFC	PLQP0176K*	MSL3
41	R5F5631DDGFB	PLQP0144K*	MSL3	91	R5F5631KDGF	PLQP0176K*	MSL3
42	R5F5631ECDFB	PLQP0144K*	MSL3	92	R5F5631WDDFC	PLQP0176K*	MSL3
43	R5F5631EDDFB	PLQP0144K*	MSL3	93	R5F5631WDGFC	PLQP0176K*	MSL3
44	R5F5631EDGFB	PLQP0144K*	MSL3	94	R5F5631WHDFC	PLQP0176K*	MSL3
45	R5F5631FDDFB	PLQP0144K*	MSL3	95	R5F5631YDDFC	PLQP0176K*	MSL3
46	R5F5631FDGFB	PLQP0144K*	MSL3	96	R5F5631YDGFC	PLQP0176K*	MSL3
47	R5F5631FHDFB	PLQP0144K*	MSL3	97	R5F5631YHDFC	PLQP0176K*	MSL3
48	R5F5631GDDFB	PLQP0144K*	MSL3	98	R5F5631MCDFL	PLQP0048K*	MSL3
49	R5F5631GDGFB	PLQP0144K*	MSL3	99	R5F5631MDDFL	PLQP0048K*	MSL3
50	R5F5631JDDFB	PLQP0144K*	MSL3	100	R5F5631MDGFL	PLQP0048K*	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	R5F5631NCDFL	PLQP0048K*	MSL3	161	R5F5631DDDFR	PLQP0176L*	MSL3
102	R5F5631NDDFL	PLQP0048K*	MSL3	162	R5F5631DDGFR	PLQP0176L*	MSL3
103	R5F5631NDGFL	PLQP0048K*	MSL3	163	R5F5631ECDFR	PLQP0176L*	MSL3
104	R5F5631PCDFL	PLQP0048K*	MSL3	164	R5F5631EDDFR	PLQP0176L*	MSL3
105	R5F5631PDDFL	PLQP0048K*	MSL3	165	R5F5631EDGFR	PLQP0176L*	MSL3
106	R5F5631PDGFL	PLQP0048K*	MSL3	166	R5F56316CDLC	PTLG0177K*	MSL3
107	R5F5631MCDFM	PLQP0064K*	MSL3	167	R5F56316DDLC	PTLG0177K*	MSL3
108	R5F5631MDDFM	PLQP0064K*	MSL3	168	R5F56316SDLC	PTLG0177K*	MSL3
109	R5F5631MDGFM	PLQP0064K*	MSL3	169	R5F56317CDLC	PTLG0177K*	MSL3
110	R5F5631NCDFM	PLQP0064K*	MSL3	170	R5F56317DDLC	PTLG0177K*	MSL3
111	R5F5631NDDFM	PLQP0064K*	MSL3	171	R5F56317SDLC	PTLG0177K*	MSL3
112	R5F5631NDGFM	PLQP0064K*	MSL3	172	R5F56318CDLC	PTLG0177K*	MSL3
113	R5F5631PCDFM	PLQP0064K*	MSL3	173	R5F56318DDLC	PTLG0177K*	MSL3
114	R5F5631PDDFM	PLQP0064K*	MSL3	174	R5F56318SDLC	PTLG0177K*	MSL3
115	R5F5631PDGFM	PLQP0064K*	MSL3	175	R5F5631ACDLC	PTLG0177K*	MSL3
116	R5F56316CDFP	PLQP0100K*	MSL3	176	R5F5631ADDLC	PTLG0177K*	MSL3
117	R5F56316DDFP	PLQP0100K*	MSL3	177	R5F5631BCDLC	PTLG0177K*	MSL3
118	R5F56316DGFP	PLQP0100K*	MSL3	178	R5F5631BDDLC	PTLG0177K*	MSL3
119	R5F56317CDFP	PLQP0100K*	MSL3	179	R5F5631DCDLC	PTLG0177K*	MSL3
120	R5F56317DDFP	PLQP0100K*	MSL3	180	R5F5631DDDL	PTLG0177K*	MSL3
121	R5F56317DGFP	PLQP0100K*	MSL3	181	R5F5631ECDLC	PTLG0177K*	MSL3
122	R5F56318CDFP	PLQP0100K*	MSL3	182	R5F5631EDDL	PTLG0177K*	MSL3
123	R5F56318DDFP	PLQP0100K*	MSL3	183	R5F56318QDL	PTLG0085J*	MSL3
124	R5F56318DGFP	PLQP0100K*	MSL3	184	R5F5631ACDL	PTLG0085J*	MSL3
125	R5F56318QDFP	PLQP0100K*	MSL3	185	R5F5631ADDL	PTLG0085J*	MSL3
126	R5F5631ACDFP	PLQP0100K*	MSL3	186	R5F5631BCDL	PTLG0085J*	MSL3
127	R5F5631ADDFP	PLQP0100K*	MSL3	187	R5F5631BDDL	PTLG0085J*	MSL3
128	R5F5631ADGFP	PLQP0100K*	MSL3	188	R5F56316CDLE	PTLG0145J*	MSL3
129	R5F5631BCDFP	PLQP0100K*	MSL3	189	R5F56316DDLE	PTLG0145J*	MSL3
130	R5F5631BDDFP	PLQP0100K*	MSL3	190	R5F56316SDLE	PTLG0145J*	MSL3
131	R5F5631BDGFP	PLQP0100K*	MSL3	191	R5F56317CDLE	PTLG0145J*	MSL3
132	R5F5631DCDFP	PLQP0100K*	MSL3	192	R5F56317DDLE	PTLG0145J*	MSL3
133	R5F5631DDDFP	PLQP0100K*	MSL3	193	R5F56317SDLE	PTLG0145J*	MSL3
134	R5F5631DDGFP	PLQP0100K*	MSL3	194	R5F56318CDLE	PTLG0145J*	MSL3
135	R5F5631ECDFP	PLQP0100K*	MSL3	195	R5F56318DDLE	PTLG0145J*	MSL3
136	R5F5631EDDFP	PLQP0100K*	MSL3	196	R5F56318SDLE	PTLG0145J*	MSL3
137	R5F5631EDGFP	PLQP0100K*	MSL3	197	R5F5631ACDLE	PTLG0145J*	MSL3
138	R5F5631FDDFP	PLQP0100K*	MSL3	198	R5F5631ADDLE	PTLG0145J*	MSL3
139	R5F5631FDGFP	PLQP0100K*	MSL3	199	R5F5631BCDLE	PTLG0145J*	MSL3
140	R5F5631FHDFP	PLQP0100K*	MSL3	200	R5F5631BDDLE	PTLG0145J*	MSL3
141	R5F5631GDDFP	PLQP0100K*	MSL3	201	R5F5631DCDLE	PTLG0145J*	MSL3
142	R5F5631GDGFP	PLQP0100K*	MSL3	202	R5F5631DDDL	PTLG0145J*	MSL3
143	R5F5631JDDFP	PLQP0100K*	MSL3	203	R5F5631ECDLE	PTLG0145J*	MSL3
144	R5F5631JDGFP	PLQP0100K*	MSL3	204	R5F5631EDDL	PTLG0145J*	MSL3
145	R5F5631KDDFP	PLQP0100K*	MSL3	205	R5F5631MFDLH	PTLG0064J*	MSL3
146	R5F5631KDGFP	PLQP0100K*	MSL3	206	R5F5631PFDLH	PTLG0064J*	MSL3
147	R5F5631SQDFP	PLQP0100K*	MSL3	207	R5F56316CDLJ	PTLG0100J*	MSL3
148	R5F5631WDDFP	PLQP0100K*	MSL3	208	R5F56316DDLJ	PTLG0100J*	MSL3
149	R5F5631WDGFP	PLQP0100K*	MSL3	209	R5F56317CDLJ	PTLG0100J*	MSL3
150	R5F5631WHDFP	PLQP0100K*	MSL3	210	R5F56317DDLJ	PTLG0100J*	MSL3
151	R5F5631YDDFP	PLQP0100K*	MSL3	211	R5F56318CDLJ	PTLG0100J*	MSL3
152	R5F5631YDGFP	PLQP0100K*	MSL3	212	R5F56318DDLJ	PTLG0100J*	MSL3
153	R5F5631YHDFP	PLQP0100K*	MSL3	213	R5F5631ACDLJ	PTLG0100J*	MSL3
154	R5F5631ACDFR	PLQP0176L*	MSL3	214	R5F5631ADDLJ	PTLG0100J*	MSL3
155	R5F5631ADDFR	PLQP0176L*	MSL3	215	R5F5631BCDLJ	PTLG0100J*	MSL3
156	R5F5631ADGFR	PLQP0176L*	MSL3	216	R5F5631BDDLJ	PTLG0100J*	MSL3
157	R5F5631BCDFR	PLQP0176L*	MSL3	217	R5F5631DCDLJ	PTLG0100J*	MSL3
158	R5F5631BDDFR	PLQP0176L*	MSL3	218	R5F5631DDDLJ	PTLG0100J*	MSL3
159	R5F5631BDGFR	PLQP0176L*	MSL3	219	R5F5631ECDLJ	PTLG0100J*	MSL3
160	R5F5631DCDFR	PLQP0176L*	MSL3	220	R5F5631EDDLJ	PTLG0100J*	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
221	R5F56316CDLK	PTLG0145K*	MSL3	281			
222	R5F56316DDLK	PTLG0145K*	MSL3	282			
223	R5F56316SDLK	PTLG0145K*	MSL3	283			
224	R5F56317CDLK	PTLG0145K*	MSL3	284			
225	R5F56317DDLK	PTLG0145K*	MSL3	285			
226	R5F56317SDLK	PTLG0145K*	MSL3	286			
227	R5F56318CDLK	PTLG0145K*	MSL3	287			
228	R5F56318DDLK	PTLG0145K*	MSL3	288			
229	R5F56318SDLK	PTLG0145K*	MSL3	289			
230	R5F5631ACDLK	PTLG0145K*	MSL3	290			
231	R5F5631ADDLK	PTLG0145K*	MSL3	291			
232	R5F5631BCDLK	PTLG0145K*	MSL3	292			
233	R5F5631BDDLK	PTLG0145K*	MSL3	293			
234	R5F5631DCDLK	PTLG0145K*	MSL3	294			
235	R5F5631DDDLK	PTLG0145K*	MSL3	295			
236	R5F5631ECDLK	PTLG0145K*	MSL3	296			
237	R5F5631EDDLK	PTLG0145K*	MSL3	297			
238				298			
239				299			
240				300			
241				301			
242				302			
243				303			
244				304			
245				305			
246				306			
247				307			
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253				313			
254				314			
255				315			
256				316			
257				317			
258				318			
259				319			
260				320			
261				321			
262				322			
263				323			
264				324			
265				325			
266				326			
267				327			
268				328			
269				329			
270				330			
271				331			
272				332			
273				333			
274				334			
275				335			
276				336			
277				337			
278				338			
279				339			
280				340			

Note: MSL stands for Moisture Sensitivity Level.