DRB120-24-1

RELIABLITY DATA

INDEX

※ Test results are typical data. Nevertheless the following results are considered to be actual capability data because all units have nearly the same characteristics.

1. Calculated values for MTBF

MODEL : DRB120-24-1

1. Calculation Method

Calculated based on parts stress reliability projection of Tellcordia (*1).
Individual failure rate l_{ss} is calculated by the electric stress and temperature rise of each device.

*1 : Tellcordia (Bellcore) "Reliability Prediction Procedure for Electronic Equipment".
(Document number TR-332, Issue 5)

$$MTBF = \frac{1}{\lambda_{equip}} = \frac{1}{\sum_{i=1}^{m} N_i \cdot \lambda_{ssi}} \times 10^9 \left(hours\right)$$

$$\lambda_{ssi} = \lambda_{Gi} \cdot \pi_{Qi} \cdot \pi_{Si} \cdot \pi_{Ti}$$

Where :

λ_{equip}	:	Total equipment failure rate (FITs = Failures in 10^9 hours).
λ_{Gi}	:	Generic failure rate for the ith device.
π_{Qi}	:	Quality factor for the ith device.
π_{Si}	:	Stress factor for the ith device.
π_{Ti}	:	Temperature factor for the ith device.
m	:	Number of different device types.
N_i	:	Quantity of ith device type.

2. MTBF Values

Conditions :

Input Voltage	: 230Vac
Environmental Factor	: GB (Ground, Benign)
Output Voltage & Current	: 24VDC, 5A (100%)
Mounting Method	: Mouting A

MTBF (Ta=25°C)	≈	1291932	**Hours**
MTBF (Ta=40°C)	≈	489490	**Hours**

2. Component derating

MODEL : DRB120-24-1

(1) Calculating method

(a) Measuring Conditions

Input	:	115VAC, 230VAC	Ambient temperature	:	55°C
Output	:	24V, 5A (100%)	Mounting method	:	Standard Mounting A

(b) Semiconductors

Compared with maximum junction temperature and actual one which is calculated based on case temperature, power dissipation and thermal impedance.

(c) IC, Resistors, Capacitors, etc.

Ambient temperature, operating condition, power dissipation and so on are within derating criteria.

(d) Calculating Method of Thermal Impedance

$$\theta_{j-c} = \frac{T_{j(max)} - T_c}{P_{c(max)}} \qquad \theta_{j-a} = \frac{T_{j(max)} - T_a}{P_{c(max)}} \qquad \theta_{j-l} = \frac{T_{j(max)} - T_l}{P_{c(max)}}$$

T_c : Case temperature at start point of derating ; 25°C in general

T_a : Ambient temperature at start point of derating ; 25°C in general

T_l : Lead temperature at start point of derating ; 25°C in general

$P_{c(max)}$ ($P_{ch(max)}$) : Maximum collector(channel) dissipation

$T_{j(max)}$ ($T_{ch(max)}$) : Maximum junction(channel) temperature

(θ_{j-c}) (θ_{ch-c}) :Thermal impedance between junction(channel) and case

θ_{j-a} :Thermal impedance between junction and air

θ_{j-l} :Thermal impedance between junction and lead

2. Component Derating List

MODEL : DRB120-24-1

Location No.	Vin = 115VAC	Load = 100%	Ta = 55°C
Q1, Q2 IPD60R400CE INFINEON	Tjmax = 150°C, Pd = 1.17W, Tj = Tc + θj-c × Pd = 101.7°C, D.F. = 67.81%	θj-c = 1.12°C/W ΔTc = 45.4°C	Pd(max) = 112W Tc = 100.4°C
Q3 IPD60R400CE INFINEON	Tjmax = 150°C, Pd = 2.12W, Tj = Tc + θj-c × Pd = 98.9°C, D.F. = 65.92%	θj-c = 1.12°C/W ΔTc = 41.5°C	Pd(max) = 112W Tc = 96.5°C
Q4 IPD60R400CE INFINEON	Tjmax = 150°C, Pd = 2.35W, Tj = Tc + θj-c × Pd = 100.6°C, D.F. = 67.09%	θj-c = 1.12°C/W ΔTc = 43.0°C	Pd(max) = 112W Tc = 98.0°C
Q200 TPH8R80ANH,L1Q(M TOSHIBA	Tjmax = 150°C, Pd = 0.46W, Tj = Tc + θj-c × Pd = 98.0°C, D.F. = 65.36%	θj-c = 2.04°C/W ΔTc = 42.1°C	Pd(max) = 61W Tc = 97.1°C
Q201 TPH8R80ANH,L1Q(M TOSHIBA	Tjmax = 150°C, Pd = 0.30W, Tj = Tc + θj-c × Pd = 97.8°C, D.F. = 65.21%	θj-c = 2.04°C/W ΔTc = 42.2°C	Pd(max) = 61W Tc = 97.2°C
D1 S5MBHM4G TAIWAN SEMI	Tjmax = 150°C, Pd = 1.24W, Tj = Tc + θj-c × Pd = 96.5°C, D.F. = 64.35%	θj-c = 9.70°C/W ΔTc = 29.5°C	Pd(max) = 13W Tc = 84.5°C
D2 S5MBHM4G TAIWAN SEMI	Tjmax = 150°C, Pd = 1.24W, Tj = Tc + θj-c × Pd = 95.5°C, D.F. = 63.69%	θj-c = 9.70°C/W ΔTc = 28.5°C	Pd(max) = 13W Tc = 83.5°C
D3 S5MBHM4G TAIWAN SEMI	Tjmax = 150°C, Pd = 1.24W, Tj = Tc + θj-c × Pd = 95.8°C, D.F. = 63.89%	θj-c = 9.70°C/W ΔTc = 28.8°C	Pd(max) = 13W Tc = 83.8°C
D4 S5MBHM4G TAIWAN SEMI	Tjmax = 150°C, Pd = 1.24W, Tj = Tc + θj-c × Pd = 97.7°C, D.F. = 65.15%	θj-c = 9.70°C/W ΔTc = 30.7°C	Pd(max) = 13W Tc = 85.7°C
D6 STTH506B-TR ST	Tjmax = 175°C, Pd = 0.68W, Tj = Tc + θj-c × Pd = 99.7°C, D.F. = 56.96%	θj-c = 3.50°C/W ΔTc = 42.3°C	Pd(max) = 43W Tc = 97.3°C

2. Component Derating List

MODEL : DRB120-24-1

Location No.	Vin = 115VAC	Load = 100%	Ta = 55°C
A100 TEA1716T/2,518 NXP	Tjmax = 150°C, Pd = 0.25W, Tj = Tc + θj-a × Pd = 107.6°C, D.F. = 71.71%	θj-a = 90.00°C/W ΔTc = 29.7°C	Pd(max) = 0.80W Tc = 84.7°C
A200 TEA1995T/1J NXP	Tjmax = 150°C, Pd = 0.12W, Tj = Tc + θj-a × Pd = 120.7°C, D.F. = 80.47%	θj-a = 140.00°C/W ΔTc = 48.9°C	Pd(max) = 0.50W Tc = 103.9°C
A201 TL431BQDBZR,215 NEX PELIA	Tjmax = 150°C, Pd = 0.03W, Tj = Tc + θj-a × Pd = 93.2°C, D.F. = 62.13%	θj-a = 360.00°C/W ΔTc = 27.4°C	 Tc = 82.4°C
PC100 EL816M(K)-V EVER LIGHT	Tjmax = 125°C, Pd = 0.00W, Tj = Tc + θj-c × Pd = 76.9°C, D.F. = 61.52%	θj-c = 172.00°C/W ΔTc = 21.9°C	Pd(max) = 0.25W Tc = 76.9°C
PC101 EL816M(K)-V EVER LIGHT	Tjmax = 125°C, Pd = 0.01W, Tj = Tc + θj-c × Pd = 83.9°C, D.F. = 67.10%	θj-c = 172.00°C/W ΔTc = 27.5°C	Pd(max) = 0.25W Tc = 82.5°C
PC200 EL816M(K)-V EVER LIGHT	Tjmax = 150°C, Pd = 0.01W, Tj = Tc + θj-c × Pd = 84.5°C, D.F. = 56.34%	θj-c = 172.00°C/W ΔTc = 27.1°C	Pd(max) = 0.25W Tc = 82.1°C

2. Component Derating List

MODEL : DRB120-24-1

Location No.	Vin = 230VAC	Load = 100%	Ta = 55°C
Q1, Q2 IPD60R400CE INFINEON	Tjmax = 150°C, Pd = 0.48W, Tj = Tc + θj-c × Pd = 93.1°C, D.F. = 62.09%	θj-c = 1.12°C/W ΔTc = 37.6°C	Pd(max) = 112W Tc = 92.6°C
Q3 IPD60R400CE INFINEON	Tjmax = 150°C, Pd = 2.12W, Tj = Tc + θj-c × Pd = 93.0°C, D.F. = 61.98%	θj-c = 1.12°C/W ΔTc = 35.6°C	Pd(max) = 112W Tc = 90.6°C
Q4 IPD60R400CE INFINEON	Tjmax = 150°C, Pd = 2.35W, Tj = Tc + θj-c × Pd = 94.3°C, D.F. = 62.89%	θj-c = 1.12°C/W ΔTc = 36.7°C	Pd(max) = 112W Tc = 91.7°C
Q200 TPH8R80ANH,L1Q(M TOSHIBA	Tjmax = 150°C, Pd = 0.46W, Tj = Tc + θj-c × Pd = 95.9°C, D.F. = 63.96%	θj-c = 2.04°C/W ΔTc = 40.0°C	Pd(max) = 61W Tc = 95.0°C
Q201 TPH8R80ANH,L1Q(M TOSHIBA	Tjmax = 150°C, Pd = 0.30W, Tj = Tc + θj-c × Pd = 95.5°C, D.F. = 63.67%	θj-c = 2.04°C/W ΔTc = 39.9°C	Pd(max) = 61W Tc = 94.9°C
D1 S5MBHM4G TAIWAN SEMI	Tjmax = 150°C, Pd = 0.65W, Tj = Tc + θj-c × Pd = 82.5°C, D.F. = 55.02%	θj-c = 9.70°C/W ΔTc = 21.2°C	Pd(max) = 13W Tc = 76.2°C
D2 S5MBHM4G TAIWAN SEMI	Tjmax = 150°C, Pd = 0.65W, Tj = Tc + θj-c × Pd = 81.3°C, D.F. = 54.22%	θj-c = 9.70°C/W ΔTc = 20.0°C	Pd(max) = 13W Tc = 75.0°C
D3 S5MBHM4G TAIWAN SEMI	Tjmax = 150°C, Pd = 0.65W, Tj = Tc + θj-c × Pd = 81.2°C, D.F. = 54.15%	θj-c = 9.70°C/W ΔTc = 19.9°C	Pd(max) = 13W Tc = 74.9°C
D4 S5MBHM4G TAIWAN SEMI	Tjmax = 150°C, Pd = 0.65W, Tj = Tc + θj-c × Pd = 81.8°C, D.F. = 54.55%	θj-c = 9.70°C/W ΔTc = 20.5°C	Pd(max) = 13W Tc = 75.5°C
D6 STTH506B-TR ST	Tjmax = 175°C, Pd = 0.63W, Tj = Tc + θj-c × Pd = 95.9°C, D.F. = 54.80%	θj-c = 3.50°C/W ΔTc = 38.7°C	Pd(max) = 43W Tc = 93.7°C

2. Component Derating List

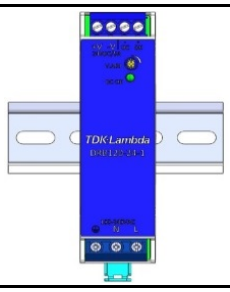
MODEL : DRB120-24-1

Location No.	Vin = 230VAC	Load = 100%	Ta = 55°C
A100 TEA1716T/2,518 NXP	Tjmax = 150°C, Pd = 0.25W, Tj = Tc + θj-a × Pd = 105.4°C, D.F. = 70.24%	θj-a = 90.00°C/W ΔTc = 27.5°C	Pd(max) = 0.80W Tc = 82.5°C
A200 TEA1995T/1J NXP	Tjmax = 150°C, Pd = 0.12W, Tj = Tc + θj-a × Pd = 118.4°C, D.F. = 78.93%	θj-a = 140.00°C/W ΔTc = 46.6°C	Pd(max) = 0.50W Tc = 101.6°C
A201 TL431BQDBZR,215 NEX PELIA	Tjmax = 150°C, Pd = 0.03W, Tj = Tc + θj-a × Pd = 89.8°C, D.F. = 59.87%	θj-a = 360.00°C/W ΔTc = 24.0°C	 Tc = 79.0°C
PC100 EL816M(K)-V EVER LIGHT	Tjmax = 125°C, Pd = 0.00W, Tj = Tc + θj-c × Pd = 74.7°C, D.F. = 59.76%	θj-c = 172.00°C/W ΔTc = 19.7°C	Pd(max) = 0.25W Tc = 74.7°C
PC101 EL816M(K)-V EVER LIGHT	Tjmax = 125°C, Pd = 0.01W, Tj = Tc + θj-c × Pd = 80.1°C, D.F. = 64.06%	θj-c = 172.00°C/W ΔTc = 23.7°C	Pd(max) = 0.25W Tc = 78.7°C
PC200 EL816M(K)-V EVER LIGHT	Tjmax = 150°C, Pd = 0.01W, Tj = Tc + θj-c × Pd = 81.7°C, D.F. = 54.47%	θj-c = 172.00°C/W ΔTc = 24.3°C	Pd(max) = 0.25W Tc = 79.3°C

3. Main components temperature rise ΔT list

MODEL : DRB120-24-1

Condition:

Standard Mounting Method	
Input Voltage (VAC)	115
Output Voltage (VAC)	24
Output Current (A)	5

		ΔT Temperature rise (°C)	
Output Derating		**Io = 100% (Ta = 55°C)**	**Io = 50% (Ta = 70°C)**
Location No	**Parts Name**	**Standard Mounting**	
Q1	MOSFET	36.0	22.1
Q2	MOSFET	45.4	27.4
Q3	MOSFET	41.5	26.2
Q4	MOSFET	43.0	26.8
Q200	MOSFET	42.1	28.4
Q201	MOSFET	42.2	28.9
D1	DIODE	29.5	17.6
D2	DIODE	28.5	17.2
D3	DIODE	28.8	17.1
D4	DIODE	30.7	17.8
D6	DIODE	42.3	25.5
A100	IC	29.7	24.1
A200	IC	48.9	36.6
A201	IC	27.4	19.5
PC100	OPTO-COUPLER	21.9	16.3
PC101	OPTO-COUPLER	27.5	19.0
PC200	OPTO-COUPLER	27.1	21.0
L1	COIL	29.7	14.1
L3	CHOKE COIL	30.8	19.5
T1	TRAANSFORMER	46.6	31.6
C10	E. CAP	28.8	18.3
C117	E. CAP	18.8	14.6
C209	E. CAP	22.5	15.5
C215	E. CAP	20.7	14.3
R8	CHIP RESISTOR	35.3	21.0
RT1	THERMISTOR	61.6	38.6
CN1	TERMINAL BLOCK	7.3	4.6
CN300	TERMINAL BLOCK	15.0	9.1

3. Main components temperature rise ΔT list

MODEL : DRB120-24-1

Condition:

Standard Mounting Method	
Input Voltage (VAC)	230
Output Voltage (VAC)	24
Output Current (A)	5

Output Derating		DT Temperature rise (°C)	
		Io = 100% (Ta = 55°C)	Io = 50% (Ta = 70°C)
Location No	**Parts Name**	**Standard Mounting**	
Q1	MOSFET	29.2	24.4
Q2	MOSFET	37.6	28.7
Q3	MOSFET	35.6	25.4
Q4	MOSFET	36.7	25.9
Q200	MOSFET	40.0	27.5
Q201	MOSFET	39.9	28.1
D1	DIODE	21.2	14.9
D2	DIODE	20.0	14.0
D3	DIODE	19.9	13.7
D4	DIODE	20.5	13.7
D6	DIODE	38.7	28.5
A100	IC	27.5	23.4
A200	IC	46.6	35.7
A201	IC	24.0	18.5
PC100	OPTO-COUPLER	19.7	15.5
PC101	OPTO-COUPLER	23.7	17.9
PC200	OPTO-COUPLER	24.3	19.7
L1	COIL	15.0	9.5
L3	CHOKE COIL	29.9	21.3
T1	TRAANSFORMER	43.9	30.5
C10	E. CAP	23.4	17.1
C117	E. CAP	16.8	14.0
C209	E. CAP	20.5	14.9
C215	E. CAP	18.2	13.4
R8	CHIP RESISTOR	25.3	19.5
RT1	THERMISTOR	39.7	24.8
CN1	TERMINAL BLOCK	5.3	3.9
CN300	TERMINAL BLOCK	12.1	8.3

4. Electrolytic capacitor lifetime

MODEL : DRB120-24-1

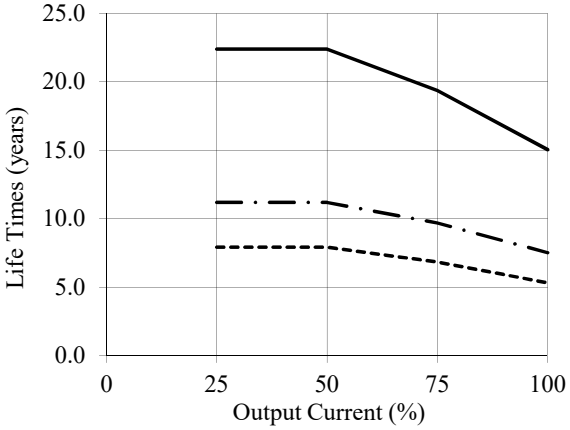
Conditions:

Standard Mounting	

Ta = 40°C
= 50°C
= 55°C

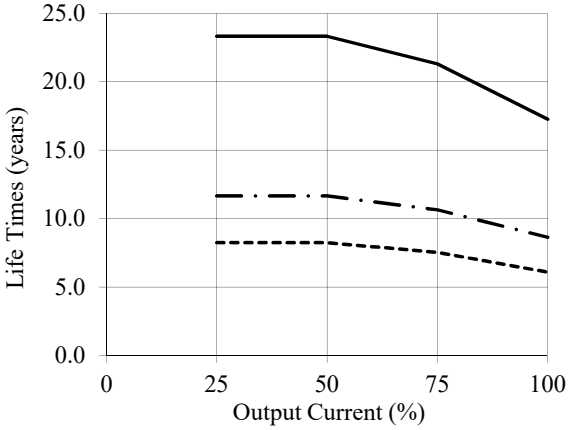
Vin = 115VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 55°C
25	22.4	11.2	7.9
50	22.4	11.2	7.9
75	19.4	9.7	6.8
100	15.0	7.5	5.3



Vin = 230VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 55°C
25	23.3	11.7	8.3
50	23.3	11.7	8.3
75	21.3	10.7	7.5
100	17.3	8.6	6.1



5. Vibration Test

MODEL : DRB120-24-1

(1) Vibration Test Class

Frequency Variable Endurance Test

(2) Equipment Used

Outside Lab Test
Jiangsu Electronic Information Product Quality Supervision & Inspection intitute
Address: No. 100 Jinshu Road, Wuxi Jiangsu P. R. China

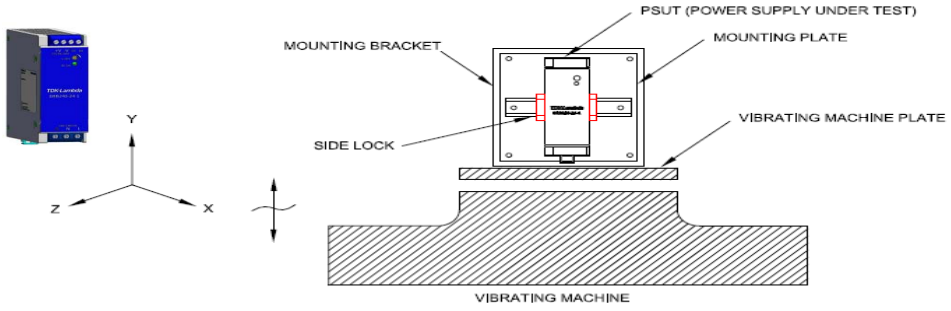
(3) The Number Of D.U.T. (Device Under Test)

1 Unit

(4) Test Conditions

Sweep Frequency	:	10 - 55Hz	Direction	:	X, Y, Z
Sweep Time	:	1 minute	Test Time	:	1 hour each axis
Acceleration	:	2.2G	Non-operation		
Mounting	:	Standard Mounting			

(5) Test Method



Fix the PSUT on the mounting rail with stopper on each corner.
Standard mounting position as per picture above.

(6) Acceptable condition

1. Not broken
2. No abnormal output after test.

(7) Test Results

PASS

6. Abnormal test

MODEL : DRB120-24-1

(1) Conditions
Input : 230Vac Output : 24V, 5A Ta : 25℃ 70%RH

(2) Test result

(Da : Damaged)

No.	Test position		Test mode		Test result *1 : Equivalent one smoke less than of a cigarette														
					a	b		c	d	e	f	g	h	I	j	k	l	
	Location No.	Test point	Short	Open	Fire	Slight Smoke Below judgment value *1	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	O.V.P.	O.C.P.	No output	No change	Others	Note
1	Q1	D-S	○									○			○			
		D-G	○								○	○			○			Da : A100, Q1
		G-S	○														○	Power factor become worse.
		D		○													○	Input power increase.
		S		○													○	Input power increase.
		G		○													○	Input power increase.
2	Q3	D-S	○								○	○			○			Da : Q4
		D-G	○								○	○			○			Da : A100, Q3, Q4
		G-S	○												○		○	Unit shutdown.
		D		○											○		○	Unit shutdown.
		S		○							○	○			○			Unit shutdown.
		G		○							○	○			○			Da : Q3, Q4
3	Q4	D-S	○								○	○			○			Da : Q3
		D-G	○								○				○			Da : A100, Q3, Q4
		G-S	○												○		○	Unit shutdown.
		D		○											○		○	Unit shutdown.
		S		○											○		○	Unit shutdown.
		G		○							○	○			○			Da : Q3, Q4
4	Q200	D-S	○														○	Unit hiccup.
		D-G	○								○						○	Da : Q200 Unit hiccup.
		G-S	○														○	Input power increase.
		D		○													○	Unit hiccup.
		S		○													○	Unit hiccup.
		G		○													○	Input power increase.
5	Q201	D-S	○														○	Unit hiccup.
		D-G	○														○	Unit hiccup.
		G-S	○														○	Input power increase.
		D		○													○	Unit hiccup.
		S		○													○	Unit hiccup.
		G		○													○	Input power increase.

No.	Test position		Test mode		Test result *1 : Equivalent one smoke less than of a cigarette													
					a	b		c	d	e	f	g	h	I	j	k	l	
	Location No.	Test point	Short	Open	Fire	Slight Smoke Below judgment value *1	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	O.V.P.	O.C.P.	No output	No change	Others	Note
6	D1	A-K	○									○			○			
		A-K		○													○	Unit hiccup.
7	D3	A-K	○									○			○			
		A-K		○													○	Unit hiccup.
8	D200	A-K	○														○	Unit hiccup.
		A-K		○													○	Input power increase.
9	C10		○									○			○			
				○							○	○			○			Da : Q1
10	C17		○								○	○			○			Da : Q3
				○													○	Unit shutdown.
11	C117		○								○				○			Da : A100
				○												○		
12	C215		○											○			○	Unit hiccup.
				○													○	Output ripple worse.
13	PC101	1-2	○														○	Unit hiccup.
		3-4	○														○	Unit hiccup.
		1		○													○	Unit hiccup.
		2		○													○	Unit hiccup.
		3		○													○	Unit hiccup.
		4		○													○	Unit hiccup.
14	T1	1-2	○								○	○			○			Da : Q3, Q4
		2-3	○								○	○			○			Da : Q3, Q4
		3-4	○														○	Unit hiccup.
		5-6	○														○	Unit hiccup.
		6-7	○														○	Unit hiccup.
		7-8	○														○	Unit hiccup.
		8-9	○														○	Unit hiccup.
		1		○											○			Unit shutdown.
		2		○											○			Unit shutdown.
		3		○													○	Unit hiccup.
		4		○													○	Unit hiccup.
		5		○													○	Unit hiccup.
		6		○											○			Unit shutdown.
		7		○													○	Unit hiccup.
		8		○													○	Input power increase.
		9		○													○	Input power increase.

7. Thermal Shock Test

MODEL : DRB120-24-1

(1) Equipment used

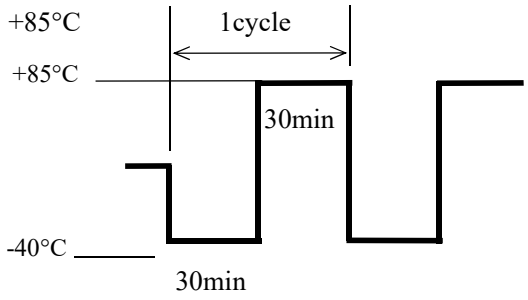
Thermal shock chamber (ESPEC CORP.)

(2) The number of D.U.T (Device Under Test)

1 unit

(3) Test Conditions

- Ambient temperature : -40°C ⟷ +85°C
- Test time : 30 min each temp.
- Test cycle : 610 cycles
- Operating : No operating



(4) Test Method

Before the test, check if there is no abnormal output and put the DUT in the testing chamber. Then test it in above cycles. After the test is completed, leave it for 1 hour at the room temperature and check to make sure that there is no abnormal output.

(5) Acceptable Condition

No abnormal output after the test

(6) Test Results

PASS