LS75

RELIABILITY DATA

DWG. No PA583-57-01		
APPD	CHK	DWG
7 Apr 08	7 Apr 08	07 April 08

DENSEI-LAMBDA

I N D E X

PAGE

※ The above data is typical value. As all units have nearly the same characteristics, the data to be considered as ability value.

1. Calculated values for MTBF

MODEL : LS75-5

1. Calculating Method

Calculated based on part count reliability projection of JEITA (RCR-9102A).
Individual failure rates λ_G is given to each part and MTBF is calculated by the count of each part.

Formula :

$$MTBF = \frac{1}{\lambda equip} = \frac{1}{\sum_{i=1}^{n} Ni\,(\lambda_G \pi_Q)_i} \times 10^6 \text{ (HOURS)}$$

where :

$\lambda equip$ = Total Equipment Failure Rate (Failure / 106 Hours)

λ_G = Generic Failure Rate For The ith Generic Part (Failure / 106 Hours)

Ni = Quantity of ith Generic Part

n = Number of Different Generic Part Categories

π_Q = Generic Quality Factor for the ith Generic Part (π_Q = 1)

2. MTBF Values

G_F : (GROUND, FIXED)

MTBF = 691,400 (Hours)

2. Component derating

MODEL : LS75-5

(1) Calculating method

(a) Measuring Conditions

Input	:	115 , 230VAC	• Ambient temperature	:	50°C
Output	:	5V 12A(100%)	• Mounting method	:	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_j : 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

Location No.	Vin = 115VAC Load = 100% Ta = 50°C		
Q2 STF11NM60N ST MICROELECTRONICS	Tchmax = 150°C, Pch = 3.65W, Tch = Tc + ((θ ch-c) × Pch) = 94.0°C D.F. = 62.7%	θ j-c = 3.57°C/W, Δ Tc = 31.0 °C,	Pch(max) = 35W Tc = 81.0°C
D8 STPS30H60CFP ST MICROELECTRONICS	Tjmax = 175°C, Pd = 7W, Tj = Tc + ((θ j-c) × Pd) = 144.0°C D.F. = 82.3%	θ j-c = 3.95°C/W Δ Tc = 66.3°C	Tc = 116.3°C
D1 RS405M RECTRON	Tjmax = 150°C, Pd = 2.24W, Tj = Tc + ((θ j-c) × Pd) = 108.8°C D.F. = 72.5%	θj-c = 6.5°C/W, Δ Tc = 44.2°C,	Tc = 94.2°C
D2 CRF02(TE85L,Q) TOSHIBA	Tjmax = 150°C, Pd = 0.1W, Tj = Tc + ((θ j-c) × Pd) = 109.1°C D.F. = 72.7%	θj-l = 20°C/W, Δ Tc = 57.1°C,	Tc = 107.1°C
D6 CRH01(TE85L,Q) TOSHIBA	Tjmax = 150°C, Pd = 0.05W, Tj = Tc + ((θ j-c) × Pd) = 89.2°C D.F. = 59.5 %	θ j-c = 20°C/W Δ Tc = 38.2°C	Tc = 88.2°C
PC1 PS2581L2-E3(D)-A (TRANSISTOR) NEC	Tjmax = 125°C, Pc = 2mW, Tj = Ta + ((θ j-a) × Pc) = 87.9°C D.F. = 70.3%	θ j-c = 150°C/W, Δ Ta = 37.9°C,	Pc(max) = 0.15W Ta = 87.9°C
PC1 PS2581L2-E3(D)-A (LED) NEC	Tjmax = 125°C, Pc = 0.012W, Tj = Ta + ((θ j-a) × Pc) = 89.7°C D.F. = 71.8%	θ j-c = 150°C/W, Δ Ta = 37.9°C,	Pc(max) = 0.15W Ta = 87.9°C
PC2 PS2581L2-E3(D)-A (TRANSISTOR) NEC	Tjmax = 125°C, Pc = 0W, Tj = Ta + ((θ j-a) × Pc) = 91.4°C D.F. = 73.1%	θ j-c = 150°C/W, Δ Ta = 41.4°C,	Pc(max) = 0.15W Ta = 91.4°C
PC2 PS2581L2-E3(D)-A (LED) NEC	Tjmax = 125°C, Pc = 0W, Tj = Ta + ((θ j-a) × Pc) = 91.4°C D.F. = 73.1%	θ j-a = 150°C/W, Δ Ta = 41.4°C,	Pc(max) = 0.15W Ta = 91.4°C
A1 HA17L431AP-TZ-E RENESAS	Tjmax = 150°C, Pd = 8mW, Tj = Tc + ((θ j-c) × Pd) = 71.9°C D.F. = 47.9%	θ j-c = 100°C/W, Δ Tc = 21.1°C,	Tc = 71.1°C
A2 FA13842N-D1-TE1 FUJI-ELEC.	Tjmax = 150°C, Pd = 0.1W, Tj = Tc + ((θ j-c) × Pd) = 95.4°C D.F. = 63.6%	θ j-c = 72°C/W Δ Tc = 38.2°C	Tc = 88.2°C
PD1 WP1154GD KING BRIGHT	IF = 6mA, Allowable IF(max)= 12mA(at Ta = 63.8°C) D.F. = 50%	Δ Tc = 13.8°C	Tc = 63.8°C

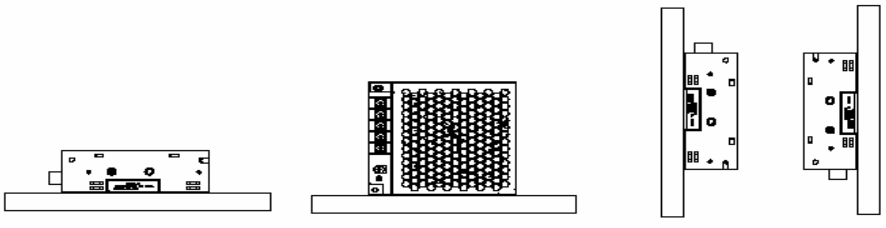
Component Derating List

Location No.	Vin = 230VAC Load = 100% Ta = 50°C		
Q2 STF11NM60N ST MICROELECTRONICS	Tchmax = 150°C, Pch = 3.2W, Tch = Tc + ((θ ch-c) × Pch) = 99.6°C D.F. = 61.7%	θ j-c = 3.57°C/W, Δ Tc = 31.1°C,	Pch(max) = 35W Tc = 81.1°C
D8 STPS30H60CFP ST MICROELECTRONICS	Tjmax = 175°C, Pd = 7W, Tj = Tc + ((θ j-c) × Pd) = 142.7°C D.F. = 81.5%	θ j-c = 3.95°C/W Δ Tc = 65.0°C	Tc = 115.0°C
D1 RS405M RECTRON	Tjmax = 150°C, Pd = 1.40W, Tj = Tc + ((θ j-c) × Pd) = 89.7°C D.F. = 59.8%	θj-c = 6.5°C/W, Δ Tc = 30.6°C,	Tc = 80.6°C
D2 CRF02(TE85L,Q) TOSHIBA	Tjmax = 150°C, Pd = 0.1W, Tj = Tc + ((θ j-c) × Pd) = 109.1°C D.F. = 72.7%	θj-l = 20°C/W, Δ Tc = 57.1°C,	Tc = 107.1°C
D6 CRH01(TE85L,Q) TOSHIBA	Tjmax = 150°C, Pd = 0.05W, Tj = Tc + ((θ j-c) × Pd) = 90.1°C D.F. = 60.0 %	θ j-c = 20°C/W Δ Tc = 39.1°C	Tc = 89.1°C
PC1 PS2581L2-E3(D)-A (TRANSISTOR) NEC	Tjmax = 125°C, Pc = 2mW, Tj = Ta + ((θ j-a) × Pc) = 88.0°C D.F. = 70.4%	θ j-a = 150°C/W, Δ Ta = 38.0°C,	Pc(max) = 0.15W Ta = 88.0°C
PC1 PS2581L2-E3(D)-A (LED) NEC	Tjmax = 125°C, Pc = 0.012W, Tj = Ta + ((θ j-a) × Pc) = 90°C D.F. = 72.0%	θ j-a = 150°C/W, Δ Ta = 38.0°C,	Pc(max) = 0.15W Ta = 88.0°C
PC2 PS2581L2-E3(D)-A (TRANSISTOR) NEC	Tjmax = 125°C, Pc = 0W, Tj = Ta + ((θ j-a) × Pc) = 91.8°C D.F. = 73.4%	θ j-a = 150°C/W, Δ Ta = 41.8°C,	Pc(max) = 0.15W Ta = 91.8°C
PC2 PS2581L2-E3(D)-A (LED) NEC	Tjmax = 125°C, Pc = 0W, Tj = Ta + ((θ j-a) × Pc) = 91.8°C D.F. = 73.4%	θ j-a = 150°C/W, Δ Ta = 41.8°C,	Pc(max) = 0.15W Ta = 91.8°C
A1 HA17L431AP-TZ-E RENESAS	Tjmax = 150°C, Pd = 8mW, Tj = Tc + ((θ j-c) × Pd) = 71.9°C D.F. = 47.9%	θ j-c = 100°C/W, Δ Tc = 21.1°C,	Tc = 71.1°C
A2 FA13842N-D1-TE1 FUJI-ELEC.	Tjmax = 150°C, Pd = 0.1W, Tj = Tc + ((θ j-c) × Pd) = 96.3°C D.F. = 64.2%	θ j-c = 72°C/W Δ Tc = 39.1°C	Tc = 89.1°C
PD1 WP1154GD KING BRIGHT	IF = 6mA, Allowable IF(max)= 12mA(at Ta = 63.9°C) D.F. = 50%	Δ Tc = 13.9°C	Tc = 63.9°C

3. Main components temperature rise ΔT list

MODEL : LS75-5

Condition:

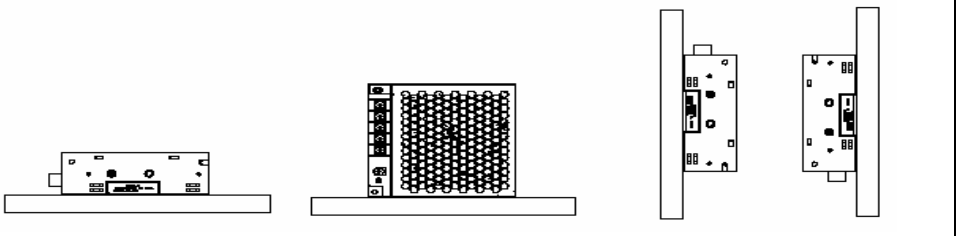
Standard Mounting (Mounting Method (A)	(A)  Mounting A Mounting B Mounting C Mounting D
Input Voltage (VAC)	115
Output Voltage (VDC)	5
Output Current (A)	12

			ΔT Temperature rise (°C)		
Output Derating Ta = 50°C		Io=100%	Io=100%	Io=70%	Io=100%
Location No	Parts Name	Mounting (A)	Mounting (B)	Mounting (C)	Mounting (D)
L1	BALUN COIL	33.0	43.0	42.2	35.6
L6	CHOKE COIL	53.8	57.2	66.5	50.0
T1	TRANS PULSE	61.5	55.7	54.3	60.3
A1	I.C	21.1	23.8	37.5	20.4
A2	CHIP I.C	38.2	33.2	31.4	42.0
PD1	LED	13.8	17.1	34.1	14.2
D1	BRIDGE DIODE	44.2	49.4	48.5	49.9
D8	OUTPUT DIODE	66.3	65.6	64.2	66.2
Q2	MOS FET	31.0	31.3	29.3	35.8
C1	FILM CAP.	31.4	40.7	48.6	28.4
C2	FILM CAP	34.3	40.1	43.0	40.1
C6	E. CAP.	29.3	34.6	26.0	34.0
C18	E. CAP.	36.8	28.3	26.4	43.1
C19	E. CAP.	36.8	25.0	22.2	36.5
C23	E. CAP.	48.2	44.7	46.1	42.3
C24	E. CAP.	47.2	44.8	42.1	43.3
C25	E. CAP.	43.6	41.3	43.5	38.2
C26	E. CAP.	46.5	45.3	45.4	42.4
C27	E. CAP.	43.8	41.0	45.2	37.5
C28	E. CAP.	43.9	47.4	49.3	39.7

3. Main components temperature rise ΔT list

MODEL : LS75-5

Condition:

	(A)
Standard Mounting (Mounting Method (A)	 Mounting A Mounting B Mounting C Mounting D
Input Voltage (VAC)	230
Output Voltage (VDC)	5
Output Current (A)	12

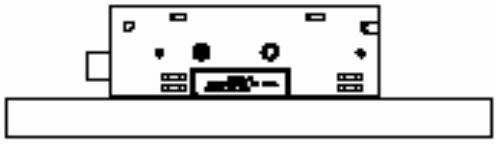
			ΔT Temperature rise (°C)		
Output Derating Ta = 50°C		Io=100%	Io=100%	Io=70%	Io=100%
Location No	Parts Name	Mounting (A)	Mounting (B)	Mounting (C)	Mounting (D)
Location No.	Parts Name	Mounting A	Mounting B	Mounting C	Mounting D
L1	BALUN COIL	24.1	33.1	30.5	25.1
L6	CHOKE COIL	54.4	57.6	66.4	50.0
T1	TRANS PULSE	63.1	56.5	55.5	60.2
A1	I.C	21.1	23.7	37.2	19.8
A2	CHIP I.C	39.1	33.5	31.6	41.9
PD1	LED	13.9	17.4	33.8	13.7
D1	BRIDGE DIODE	30.6	37.2	34.6	34.6
D8	OUTPUT DIODE	65.0	63.6	62.1	63.7
Q2	MOS FET	31.1	30.6	28.6	34.3
C1	FILM CAP.	27.7	36.8	40.1	24.3
C2	FILM CAP	26.4	33.6	32.7	29.8
C6	E. CAP.	24.6	30.6	21.8	27.4
C18	E. CAP.	37.9	28.9	27.2	43.5
C19	E. CAP.	38.2	25.7	22.9	36.5
C23	E. CAP.	45.5	42.2	43.9	39.6
C24	E. CAP.	46.0	43.2	40.9	41.5
C25	E. CAP.	41.6	39.4	41.3	36.4
C26	E. CAP.	46.0	44.1	44.2	41.3
C27	E. CAP.	43.6	40.4	44.3	36.9

4. Electrolytic capacitor lifetime

MODEL : LS75-5

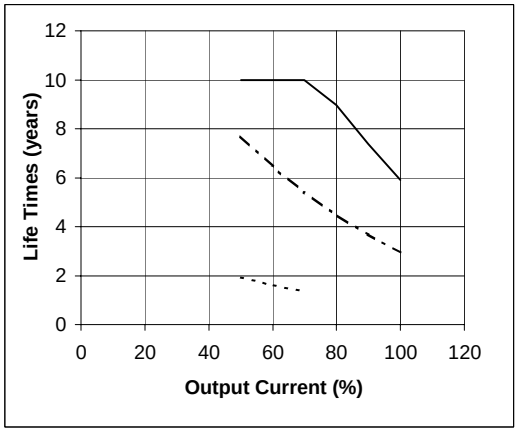
Ta = 40°C
= 50°C
= 70°C

Mounting A



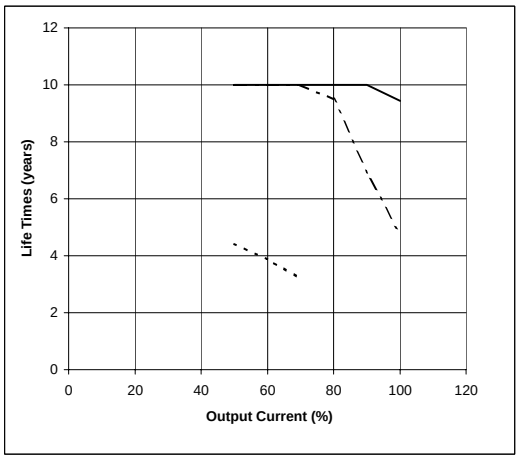
Vin = 115VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	10.0	7.7	1.9
60	10.0	6.5	1.6
70	10.0	5.4	1.3
80	9.0	4.5	-
90	7.4	3.7	-
100	5.9	3.0	-



Vin = 230VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	10.0	10.0	4.4
60	10.0	10.0	3.9
70	10.0	10.0	3.2
80	10.0	9.5	-
90	10.0	6.9	-
100	9.4	4.7	-

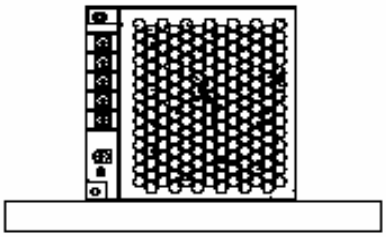


Note : E-cap life calculation is based on 8hrs/day operation.

4. Electrolytic capacitor lifetime

MODEL : LS75-5

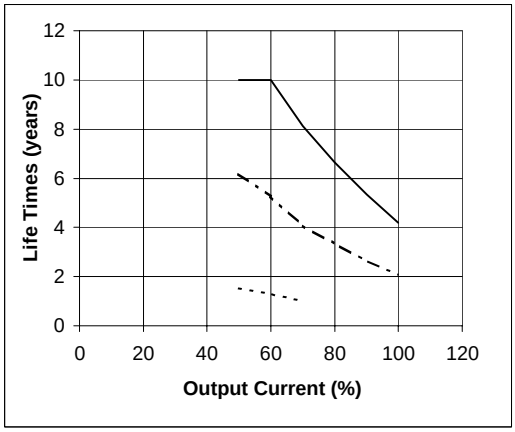
Mounting B



Ta = 40°C
= 50°C
= 70°C

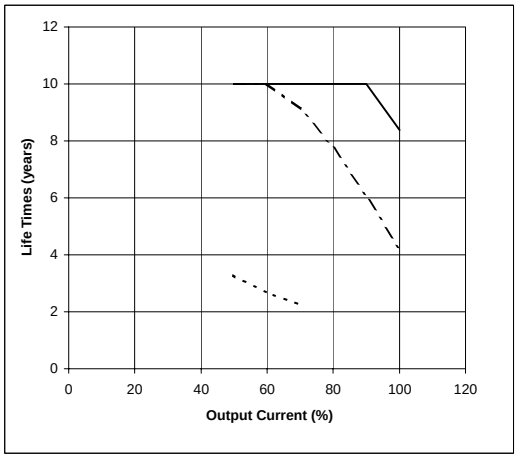
Vin = 115VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	10.0	6.2	1.5
60	10.0	5.3	1.3
70	8.1	4.1	1.0
80	6.6	3.3	-
90	5.3	2.7	-
100	4.2	2.1	-



Vin = 230VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	10.0	10.0	3.3
60	10.0	10.0	2.7
70	10.0	9.1	2.3
80	10.0	7.8	-
90	10.0	6.1	-
100	8.4	4.2	-

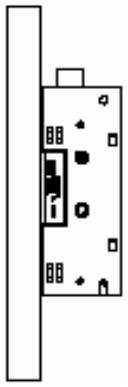


Note : E-cap life calculation is based on 8hrs/day operation.

4. Electrolytic capacitor lifetime

MODEL : LS75-5

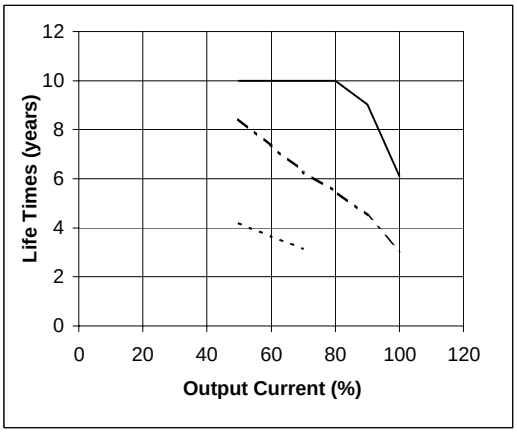
Mounting C



Ta = 40°C
= 50°C
= 60°C

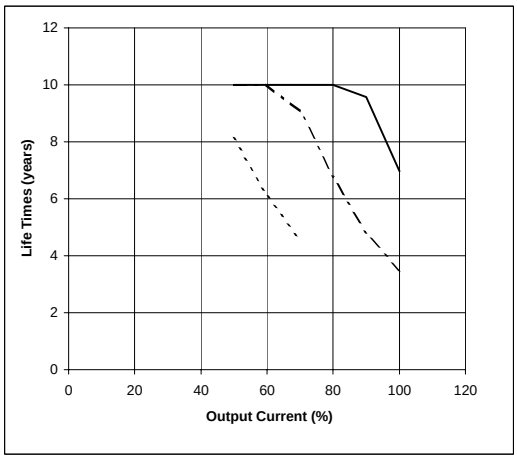
Vin = 115VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 60°C
50	10.0	8.4	4.2
60	10.0	7.3	3.7
70	10.0	6.3	3.1
80	10.0	5.5	-
90	9.0	4.5	-
100	6.1	3.1	-



Vin = 230VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 60°C
50	10.0	10.0	8.1
60	10.0	10.0	6.1
70	10.0	9.1	4.5
80	10.0	6.8	-
90	9.6	4.8	-
100	7.0	3.5	-

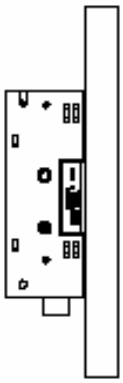


Note : E-cap life calculation is based on 8hrs/day operation.

4. Electrolytic capacitor lifetime

MODEL : LS75-5

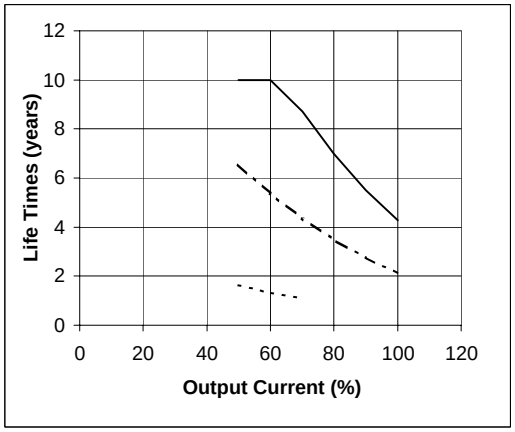
Mounting D



Ta = 40°C
= 50°C
= 70°C

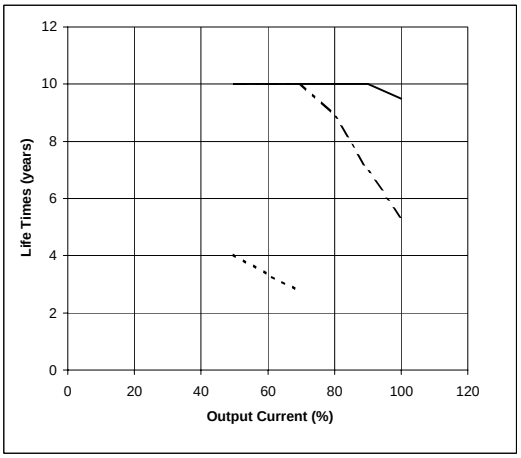
Vin = 115VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	10.0	6.6	1.6
60	10.0	5.4	1.3
70	8.7	4.4	1.1
80	7.0	3.5	-
90	5.5	2.8	-
100	4.3	2.1	-



Vin = 230VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	10.0	10.0	4.0
60	10.0	10.0	3.3
70	10.0	10.0	2.7
80	10.0	8.9	-
90	10.0	7.0	-
100	9.5	5.3	-



Note : E-cap life calculation is based on 8hrs/day operation.

5. Vibration Test

MODEL : LS75-5

(1) Vibration Test Class

Frequency Variable Endurance Test

(2) Equipment Used

Controller	:	F-400-BM-E47 (EMIC CORP.)
Vibrator	:	905-FN (EMIC CORP.)
Serial no.	:	22965

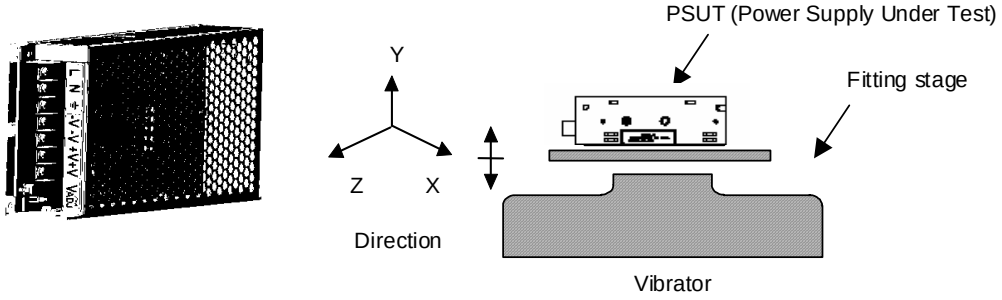
(3) The Number Of D.U.T. (Device Under Test)

1 Unit

(4) Test Conditions

Sweep Frequency	:	10 - 55Hz	Direction	:	X, Y, Z
Sweep Time	:	1 minute	Test Time	:	1 hour each axis
Acceleration	:	2G	Non-operation		
Mounting	:	A and B			

(5) Test Method



Fix the PSUT on the universal plate via two M3 tapped holes on the chassis of the power supply.
Standard mounting position as per test specification.

(6) Test results - OK

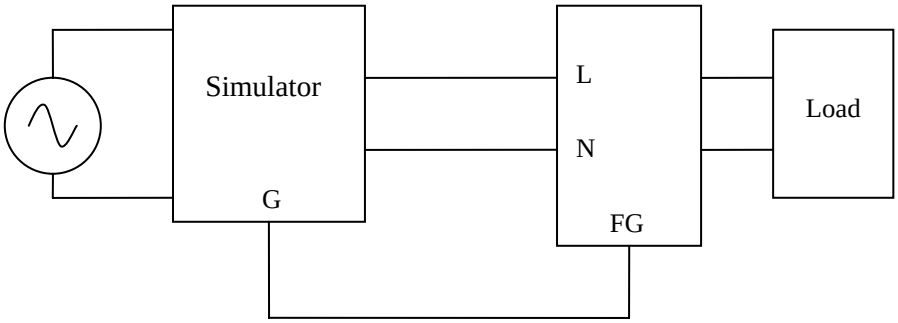
Test Conditions : Vin = 230 Vac
Ambient Temp. = +25 °C
Load Condition : Full Load

Check Item		Output Voltage (V)	PSUT State
Before Test		Vo1	
		5.010	
After test	X	5.010	OK
	Y	5.010	OK
	Z	5.010	OK

6. Noise simulate test

MODEL : LS75-5

(1) Test circuit and equipment



Simulator : INS-400L Noise Laboratory Co.,LTD

(2) Test conditions

• Input voltage	:	115, 230VAC	• Noise level	:	0V~2.4kV
• Output voltage	:	Rated	• Phase shift	:	0° ~ 360°
• Output current	:	0%, 100%	• Polarity	:	+, -
• Ambient temperature	:	25°C	• Mode	:	Normal Common
• Pulse Width	:	0ns ~ 1000ns	• Trigger select	:	Line

(3) Acceptable conditions

1. Not to be broken.
2. No output shutdown.
3. No other out of order.

(4) Test result O K

7. Abnormal test

MODEL : LS75-5

(1) Test Condition

Input Voltage : 230VAC Output Current : 100% Ta : 25°C, 70% RH

(2) Test Results

(Da: Damaged)

No.	Test Position		Test Mode		Test Results												NOTE
	LOCATION	TEST POINT	SHORT	OPEN	1 FIRE	2 SMOKE	3 BURST	4 SMELL	5 RED HOT	6 DAMAGE	7 FUSE BLOW	8 O.C.P.	9 O.V.P.	10 NO OUTPUT	11 NO CHANGE	12 OTHER	
1	D1	(+) - (-)	•							•	•			•			Da : F1
2	D2		•											•			
				•											•		
3	D3		•											•			
				•											•		
4	D4		•												•		
				•										•			
5	D5		•												•		
				•											•		
6	D7		•							•						•	Hiccup, Da : R31,R32
				•										•			
7	D8		•											•			No Damage
				•						•				•			Da : R33, A1
8	Q1	3 - 4	•											•		•	Latch
				•											•		
		1 - 6	•											•		•	Latch
				•											•		
		3 - 5	•											•		•	Latch
				•											•		
		6 - 2	•											•		•	Latch
				•											•		
9	Q2	G - S	•											•			
		D - G	•							•	•			•			Da : R33,Z1,Z2,F1
		D - S	•							•	•			•			Da : F1,R33,Z2
10	Q3	C - E	•												•		
		B - E	•													•	Hiccup
		C - B	•													•	Hiccup
11	C6	(+)Bulk - (-)Bulk	•							•	•			•			Da : F1
14	C11/R19	C11/R19	•							•				•			Da : Q3,Z2
		C11		•											•		
		R19		•											•		
12	C13		•											•			
				•											•		
13	C15		•											•			
				•						•	•			•			Da : Q2,F1,Z2

7. Abnormal test

MODEL : LS75-5

(1) Test Condition

Input Voltage : 230VAC Output Current : 100% Ta : 25°C, 70% RH

(2) Test Results

(Da: Damaged)

No.	Test Position		Test Mode		Test Results												NOTE
	LOCATION	TEST POINT	SHORT	OPEN	1 FIRE	2 SMOKE	3 BURST	4 SMELL	5 RED HOT	6 DAMAGE	7 FUSE BLOW	8 O.C.P.	9 O.V.P.	10 NO OUTPUT	11 NO CHANGE	12 OTHER	
15	C36 OR C37		•												•		
				•												•	Hissing sound
16	PC1	1 - 2	•										•	•			Latch
		3 - 4	•											•			
		1 - 2		•									•	•			Latch
		3 - 4		•										•			
17	PC2	3 - 4	•											•			
				•											•		
		1 - 2	•												•		
				•											•		
18	A1	Vcc - GND	•											•			
		Vref - GND	•											•			
		Isense - GND	•							•				•			Da : Q2,Z2
		RtCt - GND	•											•			
		FB - GND	•												•		
		Comp - GND	•											•			
		Out - GND	•											•			
19	A2	A - K	•											•			
		R - K	•													•	Vo = 3.68V
		R - A	•											•		•	Latch
20	T1	Np	•											•			
		Nbias	•											•			
		Ns	•											•			
21	PD1		•												•		
				•											•		
22	Z1		•											•			
				•											•		
23	Z2		•							•	•			•			Da : Q2,F1,Z2
				•											•		
24	Z4		•											•			
				•											•		
25	R9/C10	R9/C8	•											•			
		R9		•											•		
		C8		•											•		
26	R20		•												•		
				•											•		

7. Abnormal test

MODEL : LS75-5

(1) Test Condition

Input Voltage : 230VAC Output Current : 100% Ta : 25°C, 70% RH

(2) Test Results

(Da: Damaged)

No.	Test Position		Test Mode		Test Results												NOTE
	LOCATION	TEST POINT	SHORT	OPEN	1 FIRE	2 SMOKE	3 BURST	4 SMELL	5 RED HOT	6 DAMAGE	7 FUSE BLOW	8 O.C.P.	9 O.V.P.	10 NO OUTPUT	11 NO CHANGE	12 OTHER	
27	R29		•												•		
				•										•			
28	R30		•									•		•			
				•						•				•			Da : Q2,Z2,R33
29	R33		•							•				•			Da : Q2
				•										•			
30	R49		•										•	•		•	Latch
				•									•	•		•	Latch
31	R48		•												•		
				•												•	Hissing sound
32	VR1		•													•	Vo = 5.95
				•												•	Vo = 3.09

8. Thermal shock test

MODEL : LS75

(1) Equipment used

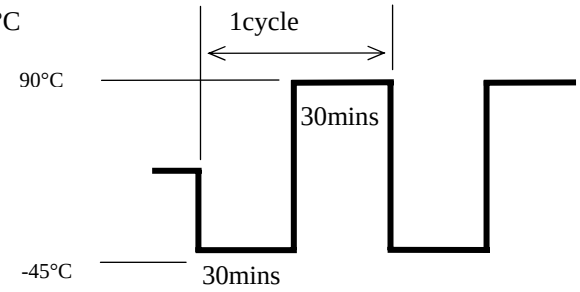
THERMAL SHOCK CHAMBER TSA-101S-W (ESPEC CORP.)

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

1 unit

(3) Test Conditions

- Ambient temperature : -45°C ⟷ 90°C
- Test time : 30 mins each temp.
- Test cycle : 100 cycles
- Not operating



(4) Test Method

Before testing, check if there is no abnormal output, then put the D.U.T. in testing chamber, and test it according to the above cycle. 100 cycles later, leave it for 1 hour at the room temperature, then check if there is no abnormal output.

(5) Test Results OK

Vin : 230VAC Io : 100%			48V			
			From		To	
Ripple&Spike noise		mV	14.4		24	
Line regulation	Full load	mV	16		28	
Load regulation	Vin:115V	mV	14		9	
Efficiency	Pin	W	87.13	87.97%	86.74	87.93%
	Vout	V	47.903		47.668	
	Iout	A	1.60		1.60	
Solder condition • etc.			————		OK	