GWS250

RELIABILITY DATA

DWG. No PA589-57-01		
APPD	CHK	DWG
26/1/11	26 Jan 11	26 Jan 2011

TDK-Lambda

I N D E X

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※ 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 : GWS250-48

1. Calculating Method

Calculated based on part count reliability projection of JEITA (RCR-9102B).
Individual failure rates l_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 :

λequip	=	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 ($\pi_Q = 1$)

2. MTBF Values

G_F : (GROUND, FIXED)

MTBF = 122,506 (Hours)

2. Component derating

MODEL : GWS250-12

(1) Calculating method

(a) Measuring Conditions

Input	:	115 , 230VAC	• Ambient temperature	:	50°C
Output	:	12V 21A(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

MODEL : GWS250

Location No.	Vin = 115VAC Load = 100% Ta = 50°C	
Q1 IPW50R250CP INFINEON	Tjmax = 150°C, θ j-c = 1.1°C/W Pd = 11.07W, Δ Tc = 52.9°C Tj = Tc + ((θ j-c) × Pd) =115.08 °C D.F. = 76.72%	Pch(max) = 114W Tc = 102.9°C
Q4 IPP50R250CP INFINEON	Tjmax = 150°C, θ j-c = 1.1°C/W Pd = 1.2W, Δ Tc = 38.7°C, Tj = Tc + ((θ j-c) × Pd) =90.02 °C D.F. = 60.01%	Pch(max) = 114W Tc = 88.7°C
Q5 IPP50R250CP INFINEON	Tjmax = 150°C, θ j-c = 1.1°C/W Pd = 1.2W, Δ Tc = 41°C, Tj = Tc + ((θ j-c) × Pd) = 92.32°C D.F. = 61.55%	Pch(max) = 114W Tc = 91°C
Q6 2SC2873-Y(TE12L,CF) TOSHIBA	Tjmax = 150°C, θ j-a = 250°C/W Pd = 0.031W, Δ Ta = 45.8°C Tj = Ta + ((θ j-a) × Pd) = 103.55°C D.F. = 69.03%	Pc(max) = 0.5W Ta = 95.8°C
Q7 2SA1213-Y(TE12L,CF) TOSHIBA	Tjmax = 150°C, θ j-a = 250°C/W Pd = 0.034W, Δ Ta = 46.6°C Tj = Ta + ((θ j-a) × Pd) = 105.1°C D.F. = 70.07%	Pc(max) = 0.5W Ta = 96.6°C
Q10 IPP040N06N3G INFINEON	Tjmax = 175°C, θj-c = 0.8°C/W, Pd = 0.63W, Δ Tc = 47.5°C, Tj = Tc + ((θ j-c) × Pd) = 98.0°C D.F. = 56.00%	Pd(max) = 188W Tc = 97.5°C
Q11 IPP040N06N3G INFINEON	Tjmax = 175°C, θ j-c = 0.8°C/W Pd = 0.63W, Δ Tc = 45.6°C Tj = Tc + ((θ j-c) × Pd) = 96.10°C D.F. = 54.92%	Pd(max) = 188W Tc = 95.6°C
D1 RS1005M RECTRON	Tjmax = 150°C, θ j-c = 2.3°C/W Pd = 6.51W, Δ Tc = 62.2°C Tj = Tc + ((θ j-c) × Pd) = 127.17°C D.F. = 84.78%	Tc = 112.2°C
D2 FFP08S60STU FAIRCHILD	Tjmax = 150°C, θ j-c = 2.5°C/W Pd = 1.94W, Δ Tc = 44.3°C Tj = Tc + ((θ j-c) × Pd) = 99.15°C D.F. = 66.10%	Tc = 94.3°C
D4 D3F60-7063 SHINDENGEN	Tjmax = 150°C, θ j-l = 23°C/W Pd = 0.0W, Δ Tl = 40.2°C Tj = Tl + ((θ j-l) × Pd) = 90.2°C D.F. = 60.13%	Tl = 90.2°C
D5 CRH01(TE85L,Q) TOSHIBA	Tjmax = 150°C, θ j-a = 65°C/W, Pd = 0.0W, Δ Ta = 56.4°C, Tj = Ta + ((θ j-a) × Pd) = 106.4°C D.F. = 70.93%	Ta = 106.4°C

(2) Component Derating List

MODEL : GWS250

Location No.	Vin = 115VAC Load = 100% Ta = 50°C
D303 CRF02(TE85L,Q) TOSHIBA	Tjmax = 150°C, θ j-l = 20°C/W, Pd = 0.012W, Δ Tl = 55°C, Tl = 105°C Tj = Tl + ((θ j-l) × Pd) = 105.24°C D.F. = 70.16%
D307 CRH01(TE85L,Q) TOSHIBA	Tjmax = 150°C, θ j-a = 65°C/W Pd = 0.11W, Δ Ta = 64.3°C Ta = 114.3°C Tj = Ta + ((θ j-a) × Pd) = 121.45°C D.F. = 80.97%
PC1 PS2861B-1Y-F3-A(L) NEC	Tjmax = 125°C, θ j-c = 330°C/W Pd(max) = 0.12W Pd = 0.0W, Δ Tc = 49.5°C, Tc = 99.5°C Tj = Tc + ((θ j-c) × Pd) = 99.5°C D.F. = 79.6%
PC2 PS2861B-1Y-F3-A(L) NEC	Tjmax = 125°C, θ j-c = 330°C/W Pd(max) = 0.12W Pd = 0.014 W, Δ Tc = 48.3°C Tc = 98.3°C Tj = Tc + ((θ j-c) × Pd) = 102.92°C D.F. = 82.34%
PC3 PS2861B-1Y-F3-A(L) NEC	Tjmax = 125°C, θ j-c = 330°C/W Pd(max) = 0.12W Pd = 0.001W, Δ Tc = 50.6°C Tc = 100.6°C Tj = Tc + ((θ j-c) × Pd) = 101.32°C D.F. = 81.06%
A1 ICE2PCS03G INFINEON	Tjmax = 150°C, θj-c = 60°C/W, Pd = 0.24W, ΔTc = 51.3°C, Tc = 101.3°C Tj = Tc + ((θ j-c) × Pd) = 115.7°C D.F. = 77.13%
A3 TEA1791AT/N1,118 NXP	Tjmax = 150°C, θ j-c = 95°C/W, Pc(max) = 0.45W Pd = 0.15W, Δ Tc = 64.6°C, Tc = 114.6°C Tj = Tc + ((θ j-c) × Pd) = 128.85°C D.F. = 85.90%
A101 L6599ADTR STMICRO	Tjmax = 150°C, θ j-c = 120°C/W, Pc(max) = 0.83W Pd = 0.09W, Δ Tc = 35°C, Tc = 85°C Tj = Tc + ((θ j-c) × Pd) = 95.8°C D.F. = 63.87%
A301 ICE3B0565JG INFINEON	Tjmax = 150°C, θ j-c = 24°C/W Pd = 0.53W, Δ Tc = 59.3°C Tc = 109.3°C Tj = Tc + ((θ j-c) × Pd) = 122.02 °C D.F. = 81.35%
A302 BA05CC0FP-E2 ROHM	Tjmax = 150°C, θ j-c = 10°C/W, Pd(max) = 1.2W Pd = 0.61W, Δ Tc = 65.5°C, Tc = 115.5°C Tj = Tc + ((θ j-c) × Pd) = 121.6°C D.F. = 81.07%
PD1 MPG4361F STANLEY	IF = 4.26mA Δ Tc = 20.2°C, Allowable IF(max)= 9.5mA(at Ta = 70.2°C) Tc = 70.2°C D.F. = 44.84%

(2) Component Derating List

MODEL : GWS250

Location No.	Vin = 230VAC Load = 100% Ta = 50°C	
Q1 IPW50R250CP INFINEON	Tjmax = 150°C, θ j-c = 1.1°C/W, Pd = 10W, Δ Tc = 37.2°C Tj = Tc + ((θ j-c) × Pd) = 98.20°C D.F. = 65.47%	Pch(max) = 114W Tc = 87.2°C
Q4 IPP50R250CP INFINEON	Tjmax = 150°C, θ j-c = 1.1°C/W, Pd = 1.2W, Δ Tc = 31.5°C, Tj = Tc + ((θ j-c) × Pd) = 82.82°C D.F. = 55.21%	Pch(max) = 114W Tc = 81.5°C
Q5 IPP50R250CP INFINEON	Tjmax = 150°C, θ j-c = 1.1°C/W, Pd =1.2W, Δ Tc = 35.5°C, Tj = Tc + ((θ j-c) × Pd) = 86.82°C D.F. = 57.88%	Pch(max) = 114W Tc = 85.5°C
Q6 2SC2873-Y(TE12L,CF) TOSHIBA	Tjmax = 150°C, θ j-a= 250°C/W Pd = 0.031W, Δ Ta = 32.8°C Tj = Ta + ((θ j-a) × Pd) = 90.55°C D.F. = 60.37%	Pc(max) = 0.5W Ta = 82.8°C
Q7 2SA1213-Y (TE12L,CF) TOSHIBA	Tjmax = 150°C, θ j-a = 250°C/W Pd = 0.033W, Δ Ta = 32.1°C Tj = Ta + ((θ j-a) × Pd) = 90.35°C D.F. = 60.23%	Pc(max) = 0.5W Ta = 82.1°C
Q10 IPP040N06N3G INFINEON	Tjmax = 175°C, θj-c = 0.8°C/W, Pd = 0.63W, Δ Tc = 42.2°C, Tj = Tc + ((θ j-c) × Pd) = 92.70°C D.F. = 52.97%	Pd(max) = 188W Tc = 92.2°C
Q11 IPP040N06N3G INFINEON	Tjmax = 175°C, θ j-c = 0.8°C/W Pd = 0.63W, Δ Tc = 40.5°C Tj = Tc + ((θ j-c) × Pd) = 91.00°C D.F. = 52.00%	Pd(max) = 188W Tc = 90.5°C
D1 RS1005M RECTRON	Tjmax = 150°C, θ j-c = 2.3°C/W Pd = 6.51W, Δ Tc = 42.9°C Tj = Tc + ((θ j-c) × Pd) = 107.87°C D.F. = 71.92%	Tc = 92.9°C
D2 FFP08S60STU FAIRCHILD	Tjmax = 150°C, θ j-c = 2.5°C/W Pd = 1.51W, Δ Tc = 32.9°C Tj = Tc + ((θ j-c) × Pd) =89.68 °C D.F. = 57.78%	Tc = 82.9°C
D4 D3F60-7063 SHINDENGEN	Tjmax = 150°C, θ j-l = 23°C/W Pd = 0.0W, Δ Tl = 28.7°C Tj = Tl + ((θ j-l) × Pd) = 78.7°C D.F. = 52.47%	Tl = 78.7°C
D5 CRH01(TE85L,Q) TOSHIBA	Tjmax = 150°C, θ j-a = 65°C/W, Pd = 0.0W, Δ Ta = 36.2°C, Tj = Ta + ((θ j-a) × Pd) = 86.2°C D.F. = 57.47%	Ta = 86.2°C

TDK-Lambda

(2) Component Derating List

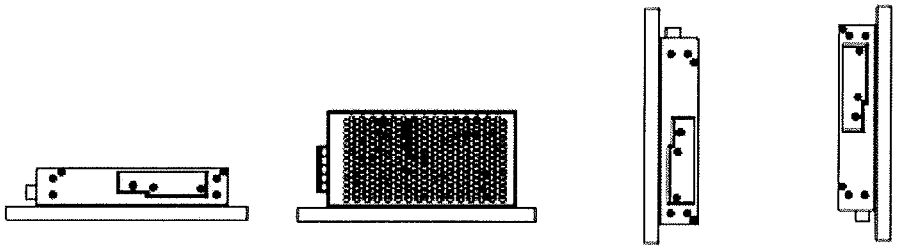
MODEL : GWS250

Location No.	Vin = 230VAC Load = 100% Ta = 50°C	
D303 CRF02(TE85L,Q) TOSHIBA	Tjmax = 150°C, θ j-l = 20°C/W, Pd = 0.012W, Δ Tl = 45.8°C, Tj = Tl + ((θ j-l) × Pd) = 96.04°C D.F. = 64.03%	Tl = 95.8°C
D307 CRH01(TE85L,Q) TOSHIBA	Tjmax = 150°C, θ j-a = 65°C/W, Pd = 0.11W, Δ Ta = 55.8°C Tj = Ta + ((θ j-a) × Pd) = 112.95°C D.F. = 75.3%	Ta = 105.8°C
PC1 PS2861B-1Y-F3-A(L) NEC	Tjmax = 125°C, θ j-c = 330°C/W Pd = 0.0W, Δ Tc = 42.6°C, Tj = Tc + ((θ j-c) × Pd) = 92.6°C D.F. = 74.08%	Pd(max) = 0.12W Tc = 92.6°C
PC2 PS2861B-1Y-F3-A(L) NEC	Tjmax = 125°C, θ j-c = 330°C/W Pd = 0.014 W, Δ Tc = 43.0°C Tj = Tc + ((θ j-c) × Pd) = 97.62°C D.F. = 78.10%	Pd(max) = 0.12W Tc = 93.0°C
PC3 PS2861B-1Y-F3-A(L) NEC	Tjmax = 125°C, θ j-c = 330°C/W Pd = 0.001W, Δ Tc = 43.6°C Tj = Tc + ((θ j-c) × Pd) = 94.32°C D.F. = 75.46%	Pd(max) = 0.12W Tc = 93.6°C
A1 ICE2PCS03G INFINEON	Tjmax = 150°C, θ j-c = 60°C/W, Pd = 0.24W, ΔTc = 42.2°C, Tj = Tc + ((θ j-c) × Pd) = 106.6°C D.F. = 71.07%	Tc = 92.2°C
A3 TEA1791AT/N1,118 NXP	Tjmax = 150°C, θ j-c = 95°C/W, Pd = 0.15W, Δ Tc = 60°C, Tj = Tc + ((θ j-c) × Pd) = 124.25°C D.F. = 82.83%	Pc(max) = 0.45W Tc = 110°C
A101 L6599ADTR STMICRO	Tjmax = 150°C, θ j-c = 120°C/W, Pd = 0.09W, Δ Tc = 31.4°C, Tj = Tc + ((θ j-c) × Pd) = 92.2°C D.F. = 61.47%	Pc(max) = 0.83W Tc = 81.4°C
A301 ICE3B0565JG INFINEON	Tjmax = 150°C, θ j-c = 24°C/W Pd = 0.53W, Δ Tc = 51.2°C Tj = Tc + ((θ j-c) × Pd) =113.92 °C D.F. = 75.95%	Tc = 101.2°C
A302 BA05CC0FP-E2 ROHM	Tjmax = 150°C, θ j-c = 10°C/W, Pd = 0.5W, Δ Tc = 60.3°C, Tj = Tc + ((θ j-c) × Pd) = 115.3°C D.F. = 76.87%	Pd(max) = 1.2W Tc = 110.3°C
PD1 MPG4361F STANLEY	IF = 4.28mA Δ Tc = 17.9°C, Allowable IF(max)= 10.5mA(at Ta = 67.9°C) D.F. =40.76 %	Tc = 67.9°C

3. Main components temperature rise ΔT list

MODEL : GWS250-12

Condition:

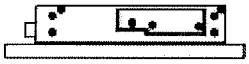
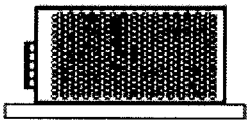
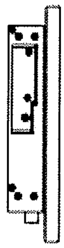
Standard Mounting (Mounting Method (A)	 Mounting A	Mounting B	Mounting C	Mounting D
Input Voltage (VAC)	115			
Output Voltage (VDC)	12			
Output Current (A)	21			

		ΔT Temperature rise (°C)			
Output Derating		Io=100% (Ta = 50°C)	Io=100% (Ta = 40°C)	Io=100% (Ta = 40°C)	Io=100% (Ta = 40°C)
Location No	Parts Name	Mounting (A)	Mounting (B)	Mounting (C)	Mounting (D)
L1	BALUN COIL	38.4	42.2	48.6	38.9
L2	BALUN COIL	48.4	45.8	49.1	44.0
L7	CHOKE COIL	57.3	56.8	52.1	58.3
T1	TRANS. PULSE	67.7	69.8	62.9	66.6
T301	TRANS. PULSE	58.5	53.5	53.8	55.3
D1	BRIDGE DIODE	62.2	52.7	54.0	54.1
D2	DIODE	44.3	45.2	43.3	48.8
Q1	MOSFET	52.9	51.1	49.3	51.3
Q4	MOSFET	38.7	43.9	34.5	41.1
Q5	MOSFET	41.0	45.0	36.9	42.6
Q10	MOSFET	47.5	52.1	48.5	46.9
Q11	MOSFET	45.6	50.8	46.9	44.3
A1	IC	51.3	51.0	46.4	53.4
A3	IC	64.6	65.7	64.8	60.6
A101	IC	35.0	44.8	31.0	48.7
A202	IC	36.7	43.6	46.6	33.7
A301	IPD	59.3	60.1	55.8	61.6
A302	IC	65.5	72.3	73.5	65.4
PC1	PHOTOCOUPLER	49.5	53.6	43.8	51.7
PC2	PHOTOCOUPLER	48.3	58.4	48.8	57.9
PC3	PHOTOCOUPLER	50.6	51.1	45.1	48.8
C14	CAP. ELECT.	27.7	36.6	26.3	41.6
C303	CAP. ELECT.	41.7	47.9	35.9	47.6
C308	CAP. ELECT.	52.2	50.7	45.4	53.1
C312	CAP. ELECT.	51.4	48.5	48.9	46.5
C41	CAP. ELECT.	49.5	54.2	52.5	47.8
C42	CAP. ELECT.	53.4	55.8	52.1	48.2
C43	CAP. ELECT.	45.7	57.4	53.1	43.3
C44	CAP. ELECT.	49.4	50.8	50.3	42.4
C47	CAP. ELECT.	31.5	46.7	51.0	36.7

3. Main components temperature rise ΔT list

MODEL : GWS250-12

Condition:

Standard Mounting (Mounting Method (A))	 Mounting A	 Mounting B	 Mounting C	 Mounting D
Input Voltage (VAC)	230			
Output Voltage (VDC)	12			
Output Current (A)	21			

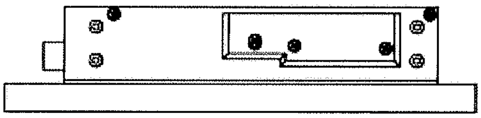
		ΔT Temperature rise (°C)			
Output Derating		Io=100% (Ta = 50°C)	Io=100% (Ta = 40°C)	Io=100% (Ta = 40°C)	Io=100% (Ta = 40°C)
Location No	Parts Name	Mounting (A)	Mounting (B)	Mounting (C)	Mounting (D)
L1	BALUN COIL	25.4	25.1	30.6	24.0
L2	BALUN COIL	33.8	30.9	33.2	30.7
L7	CHOKE COIL	41.0	39.6	36.6	41.9
T1	TRANS. PULSE	61.6	61.6	44.2	50.5
T301	TRANS. PULSE	49.5	44.3	42.1	48.3
D1	BRIDGE DIODE	42.9	33.8	34.8	35.6
D2	DIODE	32.9	30.5	29.4	33.6
Q1	MOSFET	37.2	31.1	30.0	32.5
Q4	MOSFET	31.5	34.4	27.2	33.1
Q5	MOSFET	35.5	34.6	29.1	34.1
Q10	MOSFET	42.2	43.0	40.7	39.7
Q11	MOSFET	40.5	41.5	38.9	37.2
A1	IC	42.2	37.2	34.8	40.5
A3	IC	60.0	56.8	57.3	54.5
A101	IC	31.4	35.6	26.1	41.5
A202	IC	32.1	36.0	39.3	30.4
A301	IPD	51.2	48.5	47.1	52.5
A302	IC	60.3	63.8	65.8	59.3
PC1	PHOTOCOUPLER	42.6	44.5	36.9	44.5
PC2	PHOTOCOUPLER	43.0	49.2	41.9	50.6
PC3	PHOTOCOUPLER	43.6	41.7	38.2	41.2
C14	CAP. ELECT.	21.7	28.1	20.6	33.6
C303	CAP. ELECT.	34.9	37.4	29.2	40.4
C308	CAP. ELECT.	41.5	36.1	35.5	41.9
C312	CAP. ELECT.	44.8	39.3	43.0	40.9
C41	CAP. ELECT.	45.3	46.7	46.3	43.3
C42	CAP. ELECT.	49.5	48.3	46.1	43.4
C43	CAP. ELECT.	42.9	49.5	47.1	40.0
C44	CAP. ELECT.	45.9	43.5	44.3	38.3
C47	CAP. ELECT.	30.2	39.9	45.0	33.6

4. Electrolytic capacitor lifetime

MODEL : GWS250-12

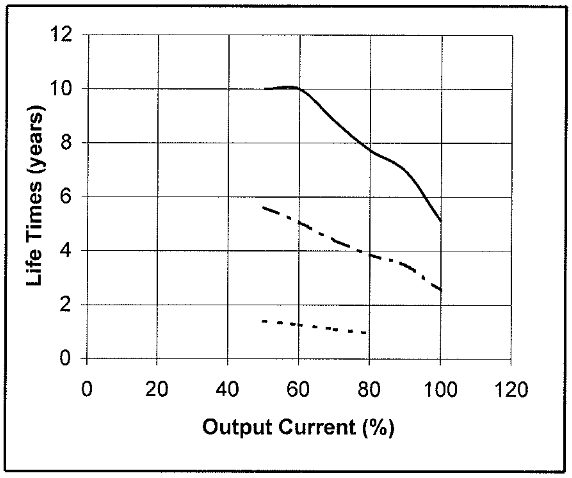
Ta = 40°C ———
= 50°C – · – · –
= 70°C ··········

Mounting A



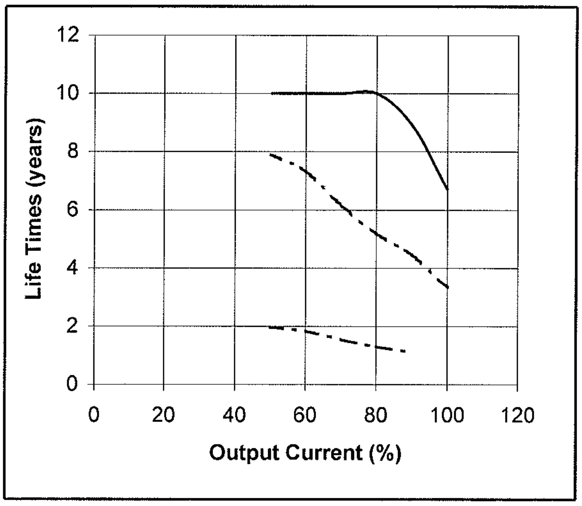
Vin = 115VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	10.0	5.6	1.4
60	10.0	5.1	1.3
70	8.8	4.4	1.1
80	7.7	3.9	1.0
90	7.0	3.5	——
100	5.1	2.6	——



Vin = 230VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	10.0	7.9	2.0
60	10.0	7.3	1.8
70	10.0	6.2	1.5
80	10.0	5.2	1.3
90	8.9	4.5	1.1
100	6.7	3.3	——



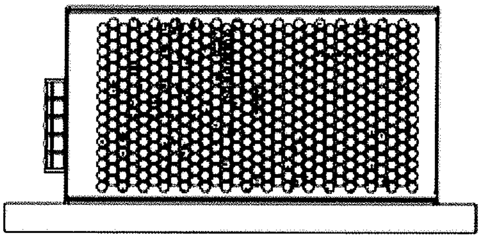
Note : E-cap life calculation is based on 24hrs/day operation.

4. Electrolytic capacitor lifetime

MODEL : GWS250-12

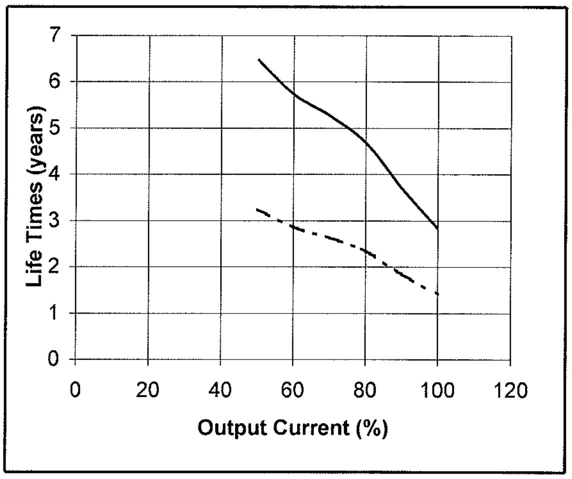
Ta = 40°C ———
= 50°C —·—·—
= 70°C ··········

Mounting B



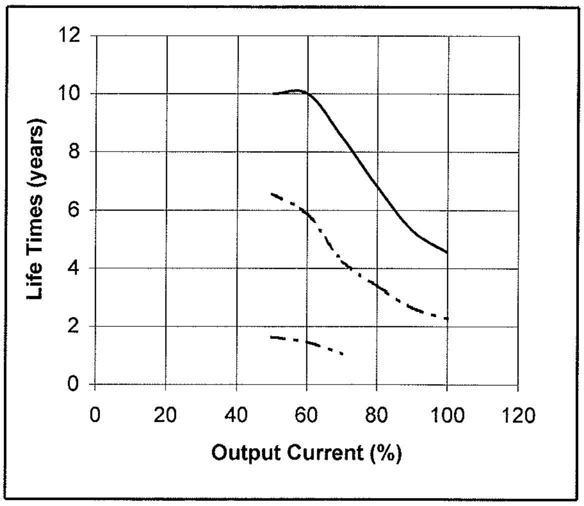
Vin = 115VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	6.5	3.2	——
60	5.7	2.9	——
70	5.3	2.6	——
80	4.7	2.3	——
90	3.7	1.9	——
100	2.8	1.4	——



Vin = 230VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	10.0	6.6	1.6
60	10.0	5.9	1.5
70	8.5	4.2	1.1
80	6.8	3.4	——
90	5.3	2.7	——
100	4.6	2.3	——



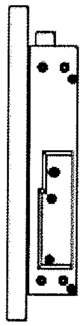
Note : E-cap life calculation is based on 24hrs/day operation.

4. Electrolytic capacitor lifetime

MODEL : GWS250-12

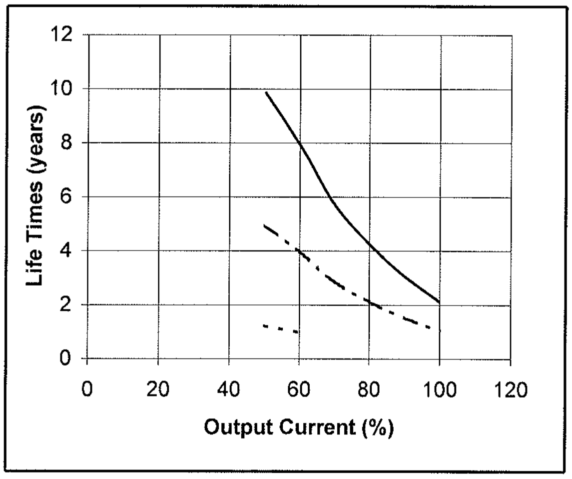
Ta = 40°C ———
= 50°C —·—·—
= 70°C ··········

Mounting C



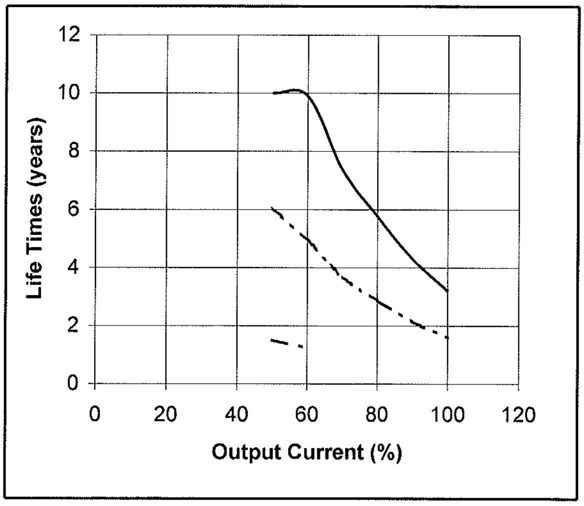
Vin = 115VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	9.9	4.9	1.2
60	7.9	4.0	1.0
70	5.7	2.9	—
80	4.2	2.1	—
90	3.1	1.5	—
100	2.1	1.1	—



Vin = 230VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	10.0	6.0	1.5
60	9.9	4.9	1.2
70	7.3	3.7	—
80	5.8	2.9	—
90	4.3	2.2	—
100	3.2	1.6	—



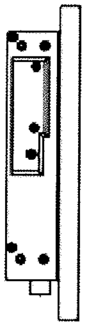
Note : E-cap life calculation is based on 24hrs/day operation.

4. Electrolytic capacitor lifetime

MODEL : GWS250-12

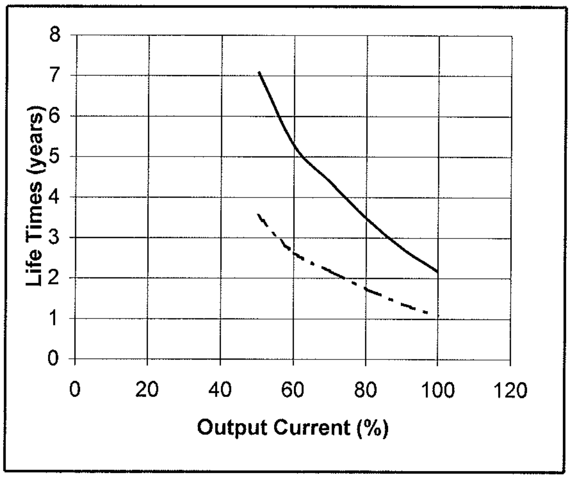
Ta = 40°C ———
= 50°C –·–·–
= 70°C ··········

Mounting D



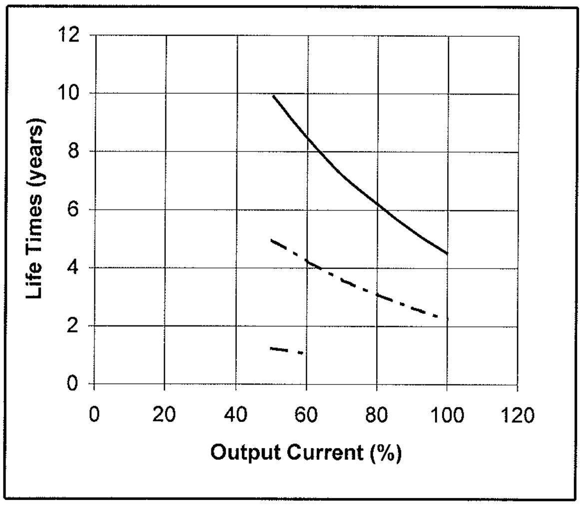
Vin = 115VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	7.1	3.6	——
60	5.3	2.6	——
70	4.4	2.2	——
80	3.5	1.7	——
90	2.7	1.4	——
100	2.2	1.1	——



Vin = 230VAC

Load (%)	Life Time (years)		
	Ta = 40°C	Ta = 50°C	Ta = 70°C
50	9.9	5.0	1.2
60	8.5	4.2	1.1
70	7.2	3.6	——
80	6.2	3.1	——
90	5.3	2.6	——
100	4.5	2.3	——



Note : E-cap life calculation is based on 24hrs/day operation.

5. Vibration Test

MODEL : GWS250-24

(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.	:	22964

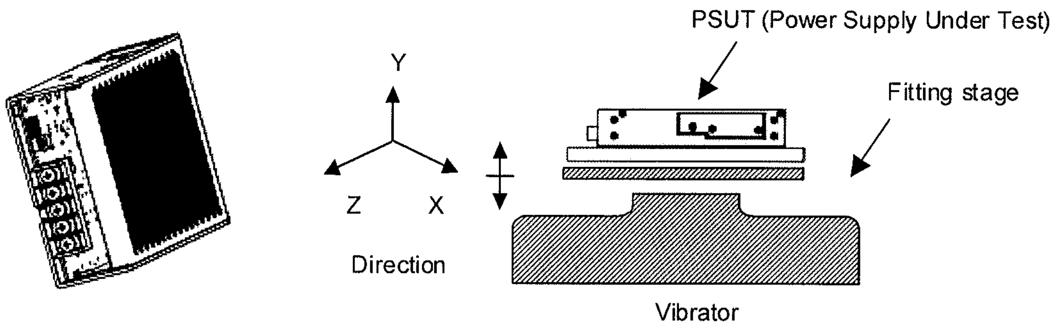
(3) The Number Of D.U.T. (Device Under Test)

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			

(5) Test Method



Fix the PSUT on the universal plate via two M4 tapped holes on the chassis of the power supply.
Standard mounting position as per test specification.

(6) Test results - OK

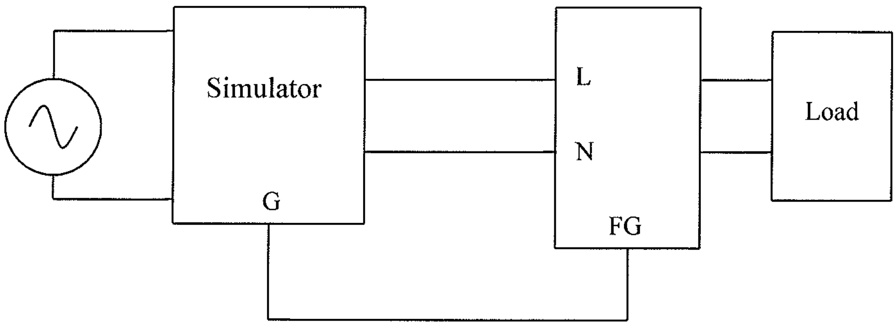
Test Conditions :	Vin	= 230 Vac	Load Condition :
	Ambient Temp.	= +25 °C	Full Load

Check Item		Output Voltage (V)	PSUT State
		Vo1	
Before Test		24.166	
After test	X	24.166	OK
	Y	24.166	OK
	Z	24.166	OK

6. Noise simulate test

MODEL : GWS250-12

(1) Test circuit and equipment



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

(2) Test conditions

- Input voltage : 115, 230VAC
- Output voltage : Rated
- Output current : 0%, 100%
- Ambient temperature : 25°C
- Pulse Width : 0ns ~ 1000ns
- Noise level : 0V~2.4kV
- Phase shift : 0° ~ 360°
- Polarity : +, -
- Mode : Normal Common
- 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: GWS250-12

(1) Test Condition and Circuit

Input Voltage: 230Vac Output: 12V 21A Ta : 25°C , 70%RH

(2) Test Results

(Da: Damaged)

No.	Test Position		Test Mode		Test Results												
	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	NOTE
1	Q4	G - S	O											√			Iin = 0.1018A, shutdown
	(DC-DC)	D - G	O							√				√			Iin = 0.1014A, Da = TFR1, Q4, Q5
	(UPPER)	D - S	O							√				√			Iin = 0.1016A, Da = TFR1, Q5
2	Q5	G - S	O											√			Iin = 0.1073A, shutdown
	(DC-DC)	D - G	O							√				√			Iin = 0.1016A, Da = TFR1, Q4, Q5
	(LOWER)	D - S	O							√				√			Iin = 0.1016A, Da = TFR1, Q4
3	C20		O											√			Iin = 0.1015A, shutdown
4	A101	1 - 2	O												√		Iin = 1.041A
	(LLC)	2 - 3	O											√			Iin = 0.1016A, shutdown
		3 - 4	O											√			Iin = 0.1057A, shutdown
		5 - 6	O											√			Iin = 0.1056A, shutdown
		6 - 7	O											√			Iin = 0.1054A, shutdown
		7 - 8	O											√			Iin = 0.1057A, shutdown
		10- 11	O											√			Iin = 0.1067A, shutdown
		11 - 12	O							√				√			Iin = 0.1017A, Da = TFR1, Q4, Q5
		14 - 15	O											√			Iin = 0.1074A, shutdown
		15 - 16	O											√			Iin = 0.1071A, shutdown
		VCC - GND	O											√			Iin = 0.1087A, shutdown
		6 - 10	O												√		Iin = 2.484A
5	PC1	1 - 2	O												√		Iin = 1.46A
	(OV)	3 - 4	O											√			Iin = 0.1062A, shutdown
6	PC2	1 - 2	O											√			Iin = 0.1062A, shutdown
	(CNT)	3 - 4	O												√		Iin = 1.46A
7	PC3	1 - 2	O											√			Iin = 0.1058A, shutdown
	(Main)	3 - 4	O											√			Iin = 0.1062A, shutdown
		3		O										√			Iin = 0.1058A, shutdown
8	Q10	D - S	O											√			Iin = 0.1057A, shutdown
9	Q11	D - S	O											√			Iin = 0.1056A, shutdown
10	T1	3,4- 7,8	O											√			Iin = 0.1055A, shutdown
	(Main)	17-18	O											√			Iin = 0.1057A, shutdown
		17-19	O											√			Iin = 0.1057A, shutdown

7. Abnormal test

Model: GWS250-12

(1) Test Condition and Circuit

Input Voltage: 230Vac Output: 12V 21A Ta : 25°C , 70%RH

(2) Test Results

(Da: Damaged)

No.	Test Position: LOCATION	Test Position: TEST POINT	Test Mode: SHORT	Test Mode: 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	NOTE
11	C14		O							√				√			Iin = 0.1013A, Da = TFR1
	(Bulk Cap)			O										√			Hiccup
12	D1	AC to +ve	O								√			√			Iin = 0.1358A, Da = F1
	(Bridge Diode)	AC to -ve	O								√			√			Iin = 0.142A, Da = F1
13	Q1	G - S	O												√		Iin = 2.475A Thermals: 3hr 12min T1 core: 81.1°C, T1 coil: 89.6°C, T301 core: 94.3°C, T301 coil: 91.2°C, PC1: 73.8°C, PC2: 77.8°C, PC3: 73.8°C, Ambient: 26.0°C
	(PFC)	D - G	O								√			√			Iin = 0.210A, Da = F1, Z4
		D - S	O								√			√			Iin = ↑, Da = F1
14	D2	A - K	O								√			√			Iin = ↑, Da = F1, Q1
15	L7	4 - 7	O								√			√			Iin = ↑, Da = F1, Q1
16	A1	7 - 3	O							√				√			Iin = 0.1021A, Da = A1
	(PFC)	1 - 7	O												√		Iin = 2.45A Thermals: 2hr 7 min T1 core: 74.8°C, T1 coil: 83.2°C, T301 core: 70.3°C, T301 coil: 69.6°C, PC1: 66.8°C, PC2: 70.2°C, PC3: 66.5°C, Ambient: 26.0°C
17	A301	7,8 - 12	O								√			√			Iin = ↑, Da = F1, Q1
	(Aux Switch)	11 - 4	O											√			Iin = 0.1019A, shutdown
		3 - 12	O											√			Iin = 0.1017A, shutdown
18	D302	A - K	O											√			Iin = 0.1055A, shutdown
19	D304	A - K	O											√			Iin = 0.1017A, shutdown
20	D306	A - K	O											√			Iin = 0.1028A, shutdown
21	T301	4 - 5	O											√			Iin = 0.1088A, shutdown
	(Aux)	1 - 2	O											√			Iin = 0.1088A, shutdown
		7 - 8	O												√		Iin = 1.46A
		8 - 9	O												√		Iin = 1.47A

8. Thermal shock test

MODEL : GWS250

(1) Equipment used

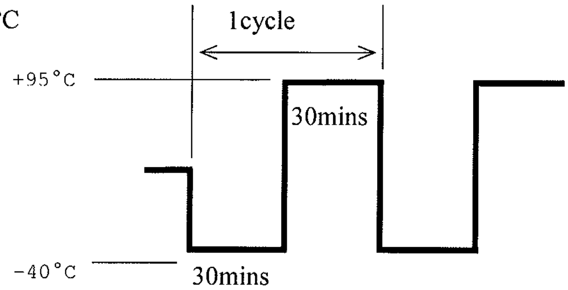
THERMAL SHOCK CHAMBER TSA-71S-A (ESPEC CORP.)

(2) The number of PSUT.(Power Supply Under Test)

1 unit

(3) Test Conditions

- Ambient temperature : -40°C ⟷ +95°C
- Test time : 30min. ~ 30min.
- Test cycle : 100 cycles
- Not operating : -



(4) Test Method

Before the test, check if there is no abnormal output and put the PSUT 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) Test Results OK

Vin : 230VAC Io : 100%			12V			
			Before		After	
Ripple & Noise		mV	54.17		45.83	
Line regulation		mV	31		28	
Load regulation		mV	2		0	
Efficiency	Pin	W	273.8	91.9%	273.9	91.7%
	Vout	V	11.997		11.994	
	Iout	A	21.0		20.9	
Solder condition		-	———		OK	