CUS1600M

RELIABILITY DATA

TDK-Lambda

INDEX

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

1. Calculated Values of MTBF

Parts stress reliability prediction MTBF

MODEL： CUS1600M-12

Calculating Method

Calculated based on parts stress reliability prediction of Telcordia (*1).
Individual failure rate λ_{SS} is calculated by the electric stress and temperature rise of the each part.

*1: Telcordia Document "Reliability Prediction Procedure for Electronic Equipment"
(Document number SR-332 Issue 3, Method I, Quality level II)

＜Formula＞

$$MTBF = \frac{1}{\lambda_{equip}} = \frac{1}{\pi_E \sum_{i=1}^{m}(N_i \cdot \lambda_{ssi})} \times 10^9 \qquad \text{(Hours)}$$

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

λ_{equip} : Total equipment failure rate (FITs = Failures in 10^9 hours)

λ_{Gi} : Generic failure rate for the ith part

π_{Qi} : Quality factor for the ith part

π_{Si} : Stress factor for the ith part

π_{Ti} : Temperature factor for the ith part

m : Number of different part types

N_i : Quantity of ith part type

π_E : Equipment environmental factor

MTBF Values

Conditions

- Input voltage ： 115VAC
- Output voltage & current ： 12VDC, 100A
- Standby voltage & current ： 5VDC, 2A
- Environmental factor ： GB (Ground, Benign)
- Mounting method ： Standard mounting A

SR-332, Issue 3

MTBF(Ta=25℃) ≒ 446,616 (Hours)

MTBF(Ta=30℃) ≒ 408,418 (Hours)

MTBF(Ta=40℃) ≒ 233,174 (Hours)

1. Calculated Values of MTBF

Parts stress reliability prediction MTBF

MODEL : CUS1600M-24

Calculating Method

Calculated based on parts stress reliability prediction of Telcordia (*1).
Individual failure rate λ_{SS} is calculated by the electric stress and temperature rise of the each part.

*1: Telcordia Document "Reliability Prediction Procedure for Electronic Equipment"
(Document number SR-332 Issue 3, Method I, Quality level II)

＜Formula＞

$$MTBF = \frac{1}{\lambda_{equip}} = \frac{1}{\pi_E \sum_{i=1}^{m}(N_i \cdot \lambda_{ssi})} \times 10^9 \quad \text{(Hours)}$$

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

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

MTBF Values

Conditions

・ Input voltage	:	115VAC
・ Output voltage & current	:	24VDC, 66.7A
・ Standby voltage & current	:	5VDC, 2A
・ Environmental factor	:	GB (Ground, Benign)
・ Mounting method	:	Standard mounting A

SR-332, Issue 3

MTBF(Ta=25℃) ≒ 573,843 (Hours)

MTBF(Ta=30℃) ≒ 470,920 (Hours)

MTBF(Ta=40℃) ≒ 348,616 (Hours)

2. Components Derating

MODEL： CUS1600M-12

(1) Calculating Method

(a) Measuring method

・Mounting method	: Standard mounting A	・Input voltage	: 115, 230VAC
・Output voltage & current	: 12V, 100A	・Ambient temperature	: 40°C
・Standby voltage & current	: 5V, 2A		

(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

$$\theta j-c=\frac{Tj(max)-Tc}{Pch(max)} \qquad \theta j-a=\frac{Tj(max)-Ta}{Pch(max)} \qquad \theta j-l=\frac{Tj(max)-Tl}{Pch(max)}$$

Tc	: Case Temperature at Start Point of Derating; 25°C in General
Ta	: Ambient Temperature at Start Point of Derating; 25°C in General
Tl	: Lead Temperature at Start Point of Derating; 25°C in General
Pch(max)	: Maximum Channel Dissipation
Tj(max) (Tch(max))	: Maximum Junction (Channel) Temperature
θj-c (θch-c)	: Thermal Impedance between Junction (Channel) and Case
θj-a	: Thermal Impedance between Junction and Air
θj-l	: Thermal Impedance between Junction and Lead

(2) Component Derating List

Location No.	Measurement condition Vin = 115VAC Iout = 100A Istb = 2A Ta = 40°C		
BD1 D35XB80-7000 SHINDENGEN	Tch (max) = 150 °C Pd= 18.6 W Tch = Tc + ((θch-c) × Pd) = 93.0 °C D.F. = 62.0%	θch-c = 0.8 °C/W ΔTc = 38.1 °C	 Tc = 78.1 °C
SCR1 TYN30W-800TNQ WEEN SEMI.	Tch (max) = 150 °C Pd = 2.8 W Tch = Tc + ((θch-c) × Pd) =72.5 °C D.F. = 48.3%	θch-c = 0.5 °C/W ΔTc = 31.1 °C	 Tc = 71.1 °C
D1 TRS20N65FB,S1Q TOSHIBA	Tch (max) = 175 °C Pd= 3.6 W Tch = Tc + ((θch-c) × Pd) = 78.6 °C D.F. = 44.2%	θch-c = 1.4 °C/W ΔTc = 32.3 °C	 Tc = 72.3 °C
Q1 IPW60R024P7 INFINEON	Tj (max) = 150 °C Pd = 12.9 W Tj = Tc + ((θj-c) × Pd) = 76.3 °C D.F. = 50.3%	θj-c = 0.43 °C/W ΔTc = 30 °C	 Tc = 70 °C
Q2A, Q2B TK39N60W5,S1VF(S TOSHIBA	Tj (max) = 150 °C Pd = 4.5 W Tj = Tc + ((θj-c) × Pd) = 71.2 °C D.F. = 47.4%	θj-c = 0.46 °C/W ΔTc = 29.1 °C	 Tc = 69.1 °C
D51 SB360-E3/73 VISHAY	Tj (max) = 150 °C Pd = 0.9 W Tj = Tl + ((θj-l) × Pd) = 83.2 °C D.F. = 55.5%	θj-l = 10 °C/W ΔTl = 34.2°C	 Tl = 74.2 °C
Q301, Q304 Q309, Q311 BSC014N06NS INFINEON	Tj (max) = 150 °C Pd = 2.1 W Tj = Tc + ((θj-c) × Pd) = 107.5 °C D.F. = 71.7%	θj-c = 0.8 °C/W ΔTc = 65.8 °C	 Tc = 105.8 °C

Terminology Used

Vin	: Input Voltage	Iout	: Output Current
Istb	: Output Current of Standby	Ta	: Ambient Temperature

(2) Component Derating List

Location No.	Measurement condition		
	Vin = 230VAC Iout = 100A	Istb = 2A	Ta = 40°C
BD1	Tch (max) = 150 °C	θch-c = 0.8 °C/W	
D35XB80-7000	Pd= 8.6 W	ΔTc = 20 °C	Tc = 60 °C
SHINDENGEN	Tch = Tc + ((θch-c) × Pd) = 66.9 °C		
	D.F. = 44.6%		
SCR1	Tch (max) = 150 °C	θch-c = 0.5 °C/W	
TYN30W-800TNQ	Pd = 2.8 W	ΔTc = 19 °C	Tc = 59 °C
WEEN SEMI.	Tch = Tc + ((θch-c) × Pd) =60.4 °C		
	D.F. = 40.3%		
D1	Tch (max) = 175 °C	θch-c = 1.4 °C/W	
TRS20N65FB,S1Q	Pd= 3.5 W	ΔTc = 19.3 °C	Tc = 59.3 °C
TOSHIBA	Tch = Tc + ((θch-c) × Pd) = 64.2 °C		
	D.F. = 36.7%		
Q1	Tj (max) = 150 °C	θj-c = 0.43 °C/W	
IPW60R024P7	Pd = 5.3 W	ΔTc = 16 °C	Tc = 56 °C
INFINEON	Tj = Tc + ((θj-c) × Pd) = 58.5 °C		
	D.F. = 38.9%		
Q2A, Q2B	Tj (max) = 150 °C	θj-c = 0.46 °C/W	
TK39N60W5,S1VF(S	Pd = 4.5 W	ΔTc = 18.6 °C	Tc = 58.6 °C
TOSHIBA	Tj = Tc + ((θj-c) × Pd) = 60.7 °C		
	D.F. = 40.4%		
D51	Tj (max) = 150 °C	θj-l = 10 °C/W	
SB360-E3/73	Pd = 0.9 W	ΔTl = 32 °C	Tl = 72 °C
VISHAY	Tj = Tl + ((θj-l) × Pd) = 81 °C		
	D.F. = 54%		
Q301, Q304	Tj (max) = 150 °C	θj-c = 0.8 °C/W	
Q309, Q311	Pd = 2.1 W	ΔTc = 57.8 °C	Tc = 97.8 °C
BSC014N06NS	Tj = Tc + ((θj-c) × Pd) = 99.5 °C		
INFINEON	D.F. = 66.3%		

Terminology Used

Vin	: Input Voltage	Iout	: Output Current
Istb	: Output Current of Standby	Ta	: Ambient Temperature

2. Components Derating

MODEL : CUS1600M-24

(1) Calculating Method

(a) Measuring method

・Mounting method	: Standard mounting A	・Input voltage	: 115, 230VAC
・Output voltage & current	: 24V, 66.7A	・Ambient temperature	: 40°C
・Standby voltage & current	: 5V, 2A		

(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

$$\theta\mathrm{j-c} = \frac{\mathrm{Tj(max) - Tc}}{\mathrm{Pch(max)}} \qquad \theta\mathrm{j-a} = \frac{\mathrm{Tj(max) - Ta}}{\mathrm{Pch(max)}} \qquad \theta\mathrm{j-l} = \frac{\mathrm{Tj(max) - Tl}}{\mathrm{Pch(max)}}$$

Tc : Case Temperature at Start Point of Derating; 25°C in General

Ta : Ambient Temperature at Start Point of Derating; 25°C in General

Tl : Lead Temperature at Start Point of Derating; 25°C in General

Pch(max) : Maximum Channel Dissipation

Tj(max) (Tch(max)) : Maximum Junction (Channel) Temperature

θj-c (θch-c) : Thermal Impedance between Junction (Channel) and Case

θj-a : Thermal Impedance between Junction and Air

θj-l : Thermal Impedance between Junction and Lead

(2) Component Derating List

Location No.	Measurement condition Vin = 115VAC Iout = 66.7A Istb = 2A Ta = 40°C		
BD1 D35XB80-7000 SHINDENGEN	Tch (max) = 150 °C Pd= 24.8 W Tch = Tc + ((θch-c) × Pd) = 108.9 °C D.F.= 72.6 %	θch-c = 0.8 °C/W ΔTc = 49.1 °C	 Tc = 89.1 °C
SCR1 TYN30W-800TNQ WEEN SEMI.	Tch (max) = 150 °C Pd = 3.8 W Tch = Tc + ((θch-c) × Pd) =86.4 °C D.F.= 57.6 %	θch-c = 0.5 °C/W ΔTc = 44.5 °C	 Tc = 84.5 °C
D1 TRS20N65FB,S1Q TOSHIBA	Tch (max) = 175 °C Pd= 4.7 W Tch = Tc + ((θch-c) × Pd) = 94.4 °C D.F.= 53.9 %	θch-c = 1.4 °C/W ΔTc = 47.8 °C	 Tc = 87.8 °C
Q1 IPW60R024P7 INFINEON	Tj (max) = 150 °C Pd = 20.8 W Tj = Tc + ((θj-c) × Pd) = 100.0 °C D.F.= 66.7 %	θj-c = 0.43 °C/W ΔTc = 51.1 °C	 Tc = 91.1 °C
Q2A, Q2B TK39N60W5,S1VF(S TOSHIBA	Tj (max) = 150 °C Pd = 7.5 W Tj = Tc + ((θj-c) × Pd) = 90.1 °C D.F.= 60.1 %	θj-c = 0.46 °C/W ΔTc = 46.6 °C	 Tc = 86.6 °C
D51 SB360-E3/73 VISHAY	Tj (max) = 150 °C Pd = 0.9 W Tj = Tl + ((θj-l) × Pd) = 95.4 °C D.F.= 63.6 %	θj-l = 10 °C/W ΔTl = 46.4 °C	 Tl = 86.4 °C
Q301, Q304 Q309, Q311 TPH2R408QM,LQ(M1 TOSHIBA	Tj (max) = 175 °C Pd = 1.7 W Tj = Tc + ((θj-c) × Pd) = 97.8 °C D.F.= 55.9 %	θj-c = 0.71 °C/W ΔTc = 56.6 °C	 Tc = 96.6 °C

Terminology Used

Vin : Input Voltage

Iout : Output Current

Istb : Output Current of Standby

Ta : Ambient Temperature

(2) Component Derating List

Location No.	Measurement condition		
	Vin = 230VAC Iout = 66.7A	Istb = 2A	Ta = 40°C
BD1 D35XB80-7000 SHINDENGEN	Tch (max) = 150 °C Pd= 11.5W Tch = Tc + ((θch-c) × Pd) = 56.0 °C D.F.= 37.3 %	θch-c = 0.8 °C/W ΔTc = 26.8 °C	 Tc = 46.8 °C
SCR1 TYN30W-800TNQ WEEN SEMI.	Tch (max) = 150 °C Pd = 3.8 W Tch = Tc + ((θch-c) × Pd) =69.6 °C D.F.= 46.4 %	θch-c = 0.5 °C/W ΔTc = 27.7 °C	 Tc = 67.7 °C
D1 TRS20N65FB,S1Q TOSHIBA	Tch (max) = 175 °C Pd= 4.7 W Tch = Tc + ((θch-c) × Pd) = 75.7 °C D.F.= 43.3 %	θch-c = 1.4 °C/W ΔTc = 29.1 °C	 Tc = 69.1 °C
Q1 IPW60R024P7 INFINEON	Tj (max) = 150 °C Pd = 6.7 W Tj = Tc + ((θj-c) × Pd) = 69.4 °C D.F.= 46.3 %	θj-c = 0.43 °C/W ΔTc = 26.5 °C	 Tc = 66.5 °C
Q2A, Q2B TK39N60W5,S1VF(S TOSHIBA	Tj (max) = 150 °C Pd = 7.5 W Tj = Tc + ((θj-c) × Pd) = 73.5 °C D.F.= 49.0 %	θj-c = 0.46 °C/W ΔTc = 30 °C	 Tc = 70 °C
D51 SB360-E3/73 VISHAY	Tj (max) = 150 °C Pd = 0.9 W Tj = Tl + ((θj-l) × Pd) =88.4 °C D.F. = 58.9 %	θj-l = 10 °C/W ΔTl = 39.4 °C	 Tl = 79.4 °C
Q301, Q304 Q309, Q311 TPH2R408QM,LQ(M1 TOSHIBA	Tj (max) = 175 °C Pd = 1.7 W Tj = Tc + ((θj-c) × Pd) = 90.3 °C D.F.= 51.6 %	θj-c = 0.71 °C/W ΔTc = 49.1 °C	 Tc = 89.1 °C

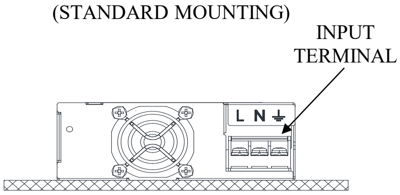
Terminology Used

Vin	: Input Voltage	Iout	: Output Current
Istb	: Output Current of Standby	Ta	: Ambient Temperature

3. Main Components Temperature Rise △T List

MODEL : CUS1600M-12

(1) Measuring Conditions

Mounting Method (Standard Mounting : A)	Mounting A	
	(STANDARD MOUNTING) 	
Input Voltage	115VAC	230VAC
Output Voltage	12V	
Output Current	100A	
Standby Current	2A	
Ambient Temperature	40°C	

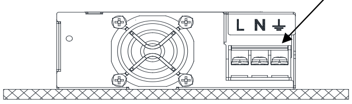
(2) Measuring Results

		ΔT Temperature Rise (°C)	
Input Voltage		115VAC	230VAC
Location No.	Part name	Mounting A	
A103	IC	12.6	8.7
A104	IC	12.9	9.7
A109	IC	18.4	15.5
A110	IPD	25.1	22.4
A301, A302	IC	47.2	46.6
A303	IC	29.3	25.1
A308	IC	38.4	35.7
BD1	DIODE BRIDGE	38.1	20.0
C6	CAP.	4.2	3.1
C10	CAP.	9.2	4.1
C51	E.CAP.	38.2	31.0
C52	E.CAP.	42.4	36.0
C8	E.CAP.	11.1	6.5
C7	CAP.	17.3	12.4
C56	E.CAP.	23.4	20.5
D1	SBD	32.3	19.3
D51	SBD	34.2	32.0
L1	CHOKE COIL	27.4	9.2
L2	CHOKE COIL	25.6	8.2
L3	CHOKE COIL	21.3	13.2
L301	CHOKE COIL	31.7	23.5
Q1	MOS FET	30.0	16.0
Q2A, Q2B	MOS FET	29.1	18.6
Q301, Q304 Q309, Q311	MOS FET	65.8	57.8
R107, R108	RESISTOR	18.1	11.3
R315~R317	RESISTOR	38.8	37.8
SCR1	THYRISTOR	31.1	19.0
T1, T2	TRANS	63.0	55.7
T3	TRANS	24.0	21.1

3. Main Components Temperature Rise △T List

MODEL : CUS1600M-24

(1) Measuring Conditions

Mounting Method	Mounting A	
(Standard Mounting : A)	(STANDARD MOUNTING) 	
Input Voltage	115VAC	230VAC
Output Voltage	24V	
Output Current	66.7A	
Standby Current	2A	
Ambient Temperature	40°C	

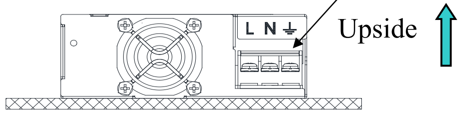
(2) Measuring Results

		ΔT Temperature Rise (°C)	
Input Voltage		115VAC	230VAC
Location No.	Part name	Mounting A	
A103	IC	14.8	8.0
A104	IC	14.5	10.3
A109	IC	20.2	16.2
A110	IPD	38.4	34.7
A301, A302	IC	43.6	44.9
A303	IC	28	25.8
A308	IC	54	44.9
BD1	DIODE BRIDGE	49.1	26.8
C6	CAP.	4.7	3.0
C10	CAP.	12.4	5.6
C51	E.CAP.	42.7	35.5
C52	E.CAP.	37.3	30.1
C8	E.CAP.	17.5	9.5
C7	CAP.	22.2	18.4
C56	E.CAP.	25.8	22.6
D1	SBD	47.8	29.1
D51	SBD	46.4	39.4
L1	CHOKE COIL	48.9	14.6
L2	CHOKE COIL	42.3	12.7
L3	CHOKE COIL	24.3	15.6
L301	CHOKE COIL	31.7	23.5
Q1	MOS FET	51.1	26.5
Q2A, Q2B	MOS FET	46.6	30.0
Q301, Q304 Q309, Q311	MOS FET	56.6	49.1
R107, R108	RESISTOR	24.5	13.6
R315~R317	RESISTOR	32.9	34.1
SCR1	THYRISTOR	44.5	27.7
T1, T2	TRANS	64.9	57.9
T3	TRANS	25.5	21.9

4. Electrolytic Capacitor Lifetime

MODEL : CUS1600M-12

(STANDARD MOUNTING)

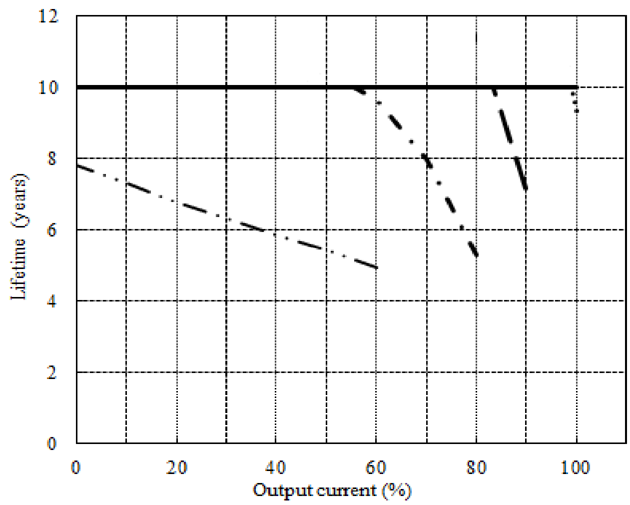


Conditions Istb : 2A (Ta ≤ 60°C)
1.6A (Ta = 70°C)

Ta 30°C : ————
40°C : ··········
50°C : — — — —
60°C : —·—·—
70°C : —··—··

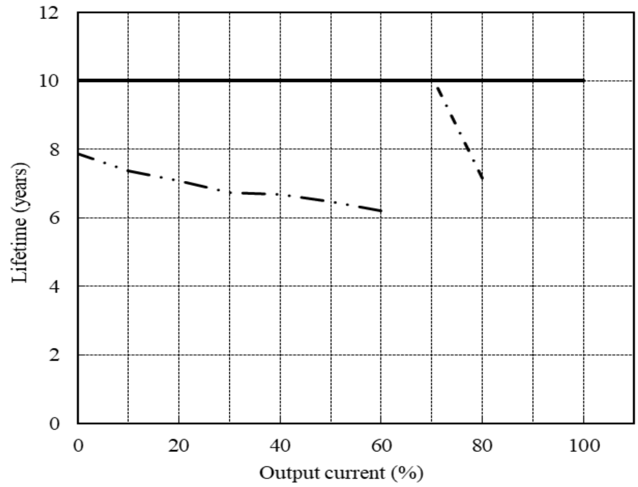
Vin=115VAC

Load (%)	Lifetime (years)				
	Ta= 30°C	Ta= 40°C	Ta= 50°C	Ta= 60°C	Ta= 70°C
100	10.0	9.3	-	-	-
90	10.0	10.0	7.2	-	-
80	10.0	10.0	10.0	5.3	-
60	10.0	10.0	10.0	9.7	5.0
40	10.0	10.0	10.0	10.0	5.9
20	10.0	10.0	10.0	10.0	6.8
0	10.0	10.0	10.0	10.0	7.8



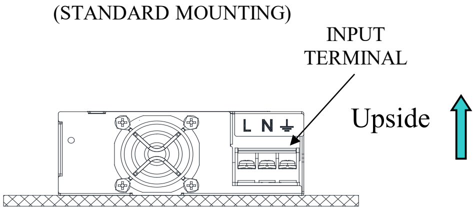
Vin=230VAC

Load (%)	Lifetime (years)				
	Ta= 30°C	Ta= 40°C	Ta= 50°C	Ta= 60°C	Ta= 70°C
100	10.0	10.0	-	-	-
90	10.0	10.0	10.0	-	-
80	10.0	10.0	10.0	7.2	-
60	10.0	10.0	10.0	10.0	6.2
40	10.0	10.0	10.0	10.0	6.7
20	10.0	10.0	10.0	10.0	7.1
0	10.0	10.0	10.0	10.0	7.9



4. Electrolytic Capacitor Lifetime

MODEL : CUS1600M-24

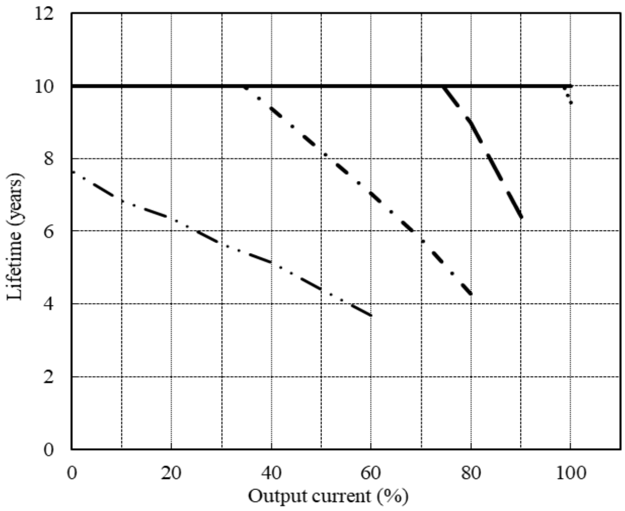


Conditions Istb : 2A（Ta ≤ 60°C）
1.6A（Ta = 70°C）

Ta 30°C : ————
40°C : ··········
50°C : — — — —
60°C : —·—·—
70°C : —··—···

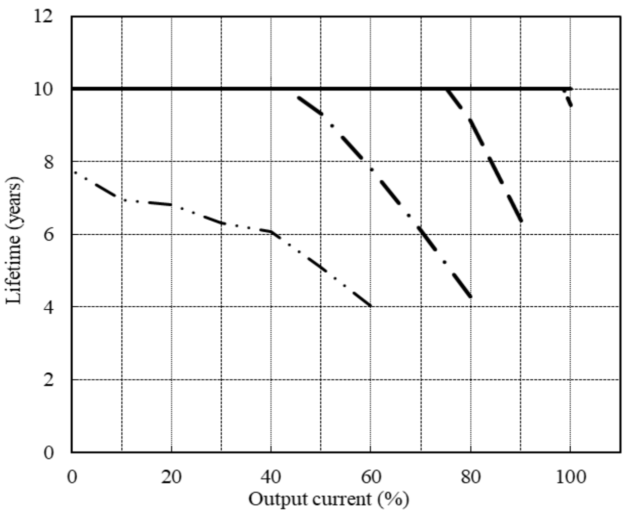
Vin=115VAC

Load (%)	Lifetime (years)				
	Ta= 30°C	Ta= 40°C	Ta= 50°C	Ta= 60°C	Ta= 70°C
100	10.0	9.5	-	-	-
90	10.0	10.0	6.4	-	-
80	10.0	10.0	9.0	4.3	-
60	10.0	10.0	10.0	7.0	3.7
40	10.0	10.0	10.0	9.4	5.1
20	10.0	10.0	10.0	10.0	6.4
0	10.0	10.0	10.0	10.0	7.7



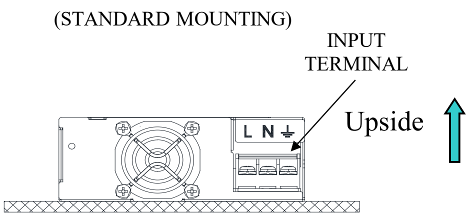
Vin=230VAC

Load (%)	Lifetime (years)				
	Ta= 30°C	Ta= 40°C	Ta= 50°C	Ta= 60°C	Ta= 70°C
100	10.0	9.5	-	-	-
90	10.0	10.0	6.4	-	-
80	10.0	10.0	9.1	4.3	-
60	10.0	10.0	10.0	7.8	4.0
40	10.0	10.0	10.0	10.0	6.1
20	10.0	10.0	10.0	10.0	6.8
0	10.0	10.0	10.0	10.0	7.8



4. Electrolytic Capacitor Lifetime

MODEL : CUS1600M-36

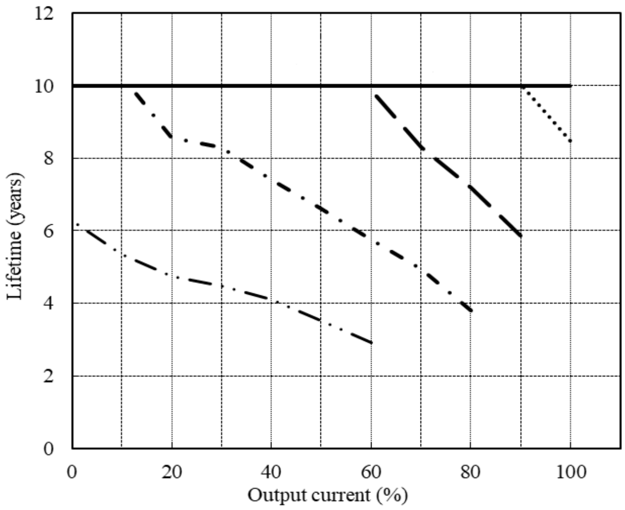


Conditions Istb : 2A（Ta ≤ 60°C）
1.6A（Ta = 70°C）

Ta 30°C :
40°C :
50°C :
60°C :
70°C :

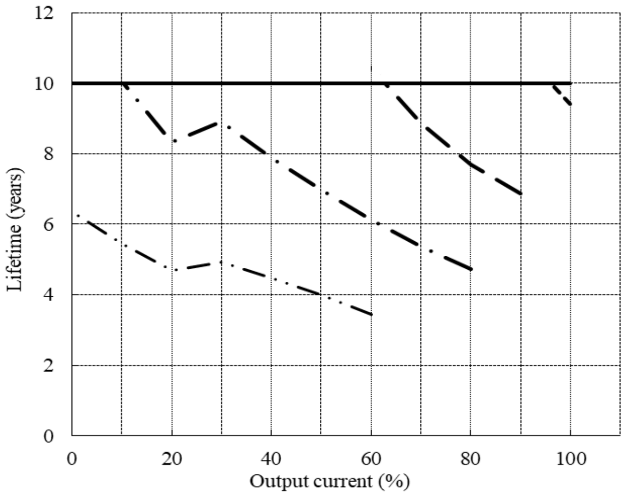
Vin=115VAC

Load (%)	Lifetime (years)				
	Ta= 30°C	Ta= 40°C	Ta= 50°C	Ta= 60°C	Ta= 70°C
100	10.0	8.5	-	-	-
90	10.0	10.0	5.9	-	-
80	10.0	10.0	7.2	3.8	-
60	10.0	10.0	9.9	5.7	2.9
40	10.0	10.0	10.0	7.4	4.1
20	10.0	10.0	10.0	8.5	4.7
0	10.0	10.0	10.0	10.0	6.3



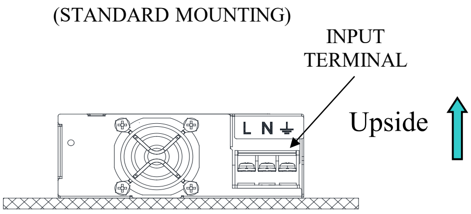
Vin=230VAC

Load (%)	Lifetime (years)				
	Ta= 30°C	Ta= 40°C	Ta= 50°C	Ta= 60°C	Ta= 70°C
100	10.0	9.4	-	-	-
90	10.0	10.0	6.9	-	-
80	10.0	10.0	7.7	4.7	-
60	10.0	10.0	10.0	6.1	3.4
40	10.0	10.0	10.0	7.9	4.5
20	10.0	10.0	10.0	8.3	4.7
0	10.0	10.0	10.0	10.0	6.4



4. Electrolytic Capacitor Lifetime

MODEL : CUS1600M-48

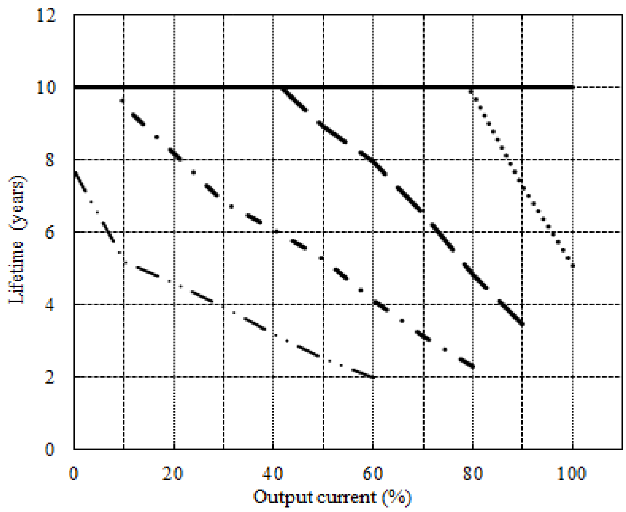


Conditions Istb : 2A (Ta ≦ 60°C)
1.6A (Ta = 70°C)

Ta 30°C : ————
40°C : ··········
50°C : — — — —
60°C : —·—·—
70°C : —··—···

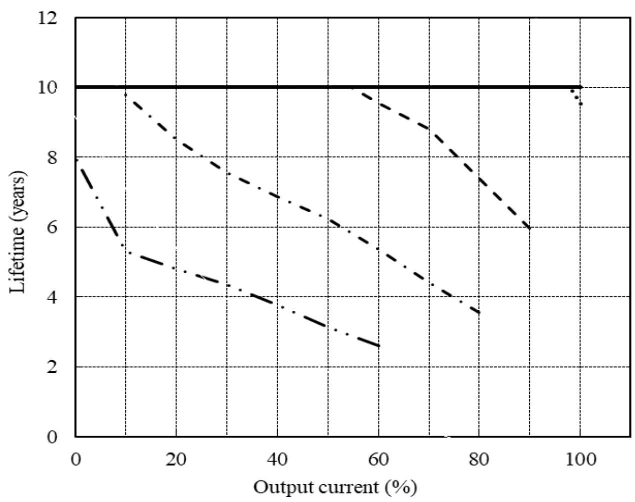
Vin=115VAC

Load (%)	Lifetime (years)				
	Ta= 30°C	Ta= 40°C	Ta= 50°C	Ta= 60°C	Ta= 70°C
100	10.0	5.1	-	-	-
90	10.0	7.3	3.5	-	-
80	10.0	9.9	4.9	2.3	-
60	10.0	10.0	8.0	4.1	2.0
40	10.0	10.0	10.0	6.1	3.2
20	10.0	10.0	10.0	8.2	4.6
0	10.0	10.0	10.0	10.0	7.7



Vin=230VAC

Load (%)	Lifetime (years)				
	Ta= 30°C	Ta= 40°C	Ta= 50°C	Ta= 60°C	Ta= 70°C
100	10.0	9.5	-	-	-
90	10.0	10.0	6.0	-	-
80	10.0	10.0	7.4	3.6	-
60	10.0	10.0	9.5	5.4	2.6
40	10.0	10.0	10.0	6.9	3.8
20	10.0	10.0	10.0	8.5	4.8
0	10.0	10.0	10.0	10.0	7.9



5. Abnormal Test

MODEL : CUS1600M-24

(1) Test Conditions

Input : 230VAC Output : 24V, 66.7A Istb : 2A Ta : 25°C

(2) Test Results

(Da:Damaged)

No.	Test position				Test result													
					a	b		c	d	e	f	g	h	I	j	k	l	
	Location No.	Test point	Short	Open	Fire	Slight Smoke	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	O.V.P.	O.C.P.	No output	No change	Others	Note
1	SCR1	A		O							O				O			Da:TFR2
		K		O							O				O			Da:TFR2
		G		O							O				O			Da:TFR2
		A-K	O														O	Input Power decreases 4W.
		A-G	O													O		
		G-K	O								O				O			Da:TFR2
2	Q1	G		O							O	O			O			Da:F1A,F1B,Q1,A102,D101,D102,R107,R108
		D		O											O			
		S		O											O			
		G-S	O												O			
		G-D	O								O	O			O			Da:F1A,F1B,A102,R107,R108,D101,D102,R112
		D-S	O								O	O			O			Da:F1A,F1B,R107,R108
3	D1	1,2&2,3	O								O				O			Da:A102,Q102,R117
		1,3		O													O	Input power increases 8W.
		2		O							O	O			O			Da:F1A,F1B,A102,D101,D102,R107,R108
4	L3		O								O				O			Da:F1B,Q1,R107,R108
				O											O			
5	C5		O								O	O			O			Da:F1A,F1B
				O												O		
6	SA1		O								O	O			O			Da:F1A,F1B
				O												O		
7	BD1	1		O											O			
		2		O											O			
		3		O											O			
		4		O											O			
		1~2	O								O	O			O			Da:F1A,F1B
		2~3	O								O	O			O			Da:F1A,F1B
		3~4	O								O	O			O			Da:F1A,F1B
		1~4	O								O	O			O			Da:F1A,F1B

5. Abnormal Test

MODEL : CUS1600M-24

(1) Test Conditions

Input : 230VAC Output : 24V, 66.7A Istb : 2A Ta : 25°C

(2) Test Results

(Da:Damaged)

No.	Test position					Test result												
	Location No.	Test point	Short	Open	a	b		c	d	e	f	g	h	I	j	k	l	Note
					Fire	Slight Smoke	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	O.V.P.	O.C.P.	No output	No change	Others	
8	Q2A	G		○							○	○			○			Da:Q2A,Q2B,F2
		D		○							○	○			○			Da:Q2A,Q2B,F2,A107
		S		○							○	○			○			Da:Q2A,Q2B,F2,A106
		G-S	○												○			
		G-D	○								○	○			○			Da:Q2A,Q2B,F2,A106
		D-S	○								○	○			○			Da:Q2B,F2
9	Q2B	G		○							○	○			○			Da:Q2A,Q2B,F2
		D		○											○			
		S		○											○			
		G-S	○												○			
		G-D	○								○	○			○			Da:Q2A,Q2B,F2,A106,A107,R181,R182
		D-S	○								○	○			○			Da:Q2A,F2
10	T3	2		○											○		○	Standby power: No output
		3		○											○		○	Standby power: No output
		5		○											○		○	Standby power: No output
		6		○											○		○	Standby power: No output
		7		○											○		○	Standby power: Hiccup
		8		○											○		○	Standby power: Hiccup
		2~3	○												○		○	Standby power: Hiccup & OCP
		5~6	○												○		○	Standby power: No output
		6~7	○								○				○		○	Da:TFR1, Standby power: No output
		7~8	○												○		○	Standby power: Hiccup & OCP
11	Q301	D		○										○	○			
		S		○										○	○			
		G		○							○				○			Da:Q301
		D~S	○											○	○			
		G~S	○														○	Input power increases 4W.
		G~D	○								○				○			Da:A301

5. Abnormal Test

MODEL : CUS1600M-24

(1) Test Conditions

Input : 230VAC　Output : 24V, 66.7A　Istb : 2A　Ta : 25°C

(2) Test Results

(Da:Damaged)

No.	Test position				Test result														
					a	b		c	d	e	f	g	h	I	j	k	l	
	Location No.	Test point	Short	Open	Fire	Slight Smoke	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	O.V.P.	O.C.P.	No output	No change	Others	Note
12	Q304	D		○										○	○			
		S		○										○	○			
		G		○							○				○			Da:Q304
		D~S	○											○	○			
		G~S	○														○	Input power increases 4W.
		G~D	○								○				○			Da:A301
13	Q309	D		○										○	○			
		S		○										○	○			
		G		○							○				○			Da:Q309
		D~S	○											○	○			
		G~S	○														○	Input power increases 2W.
		G~D	○								○				○			Da:A302
14	Q311	D		○										○	○			
		S		○										○	○			
		G		○							○				○			Da:Q311
		D~S	○											○	○			
		G~S	○														○	Input power increases 2W.
		G~D	○								○				○			Da:A302
15	T1,T2	1		○											○			
		2		○											○			
		3		○											○			
		4		○											○			
		5,8		○											○			
		1~4	○											○	○			
		2~3	○											○	○			
		5~8	○											○	○			

6. Vibration Test

MODEL： CUS1600M-12/24/36/48

(1) Vibration Test Class

Frequency variable endurance test

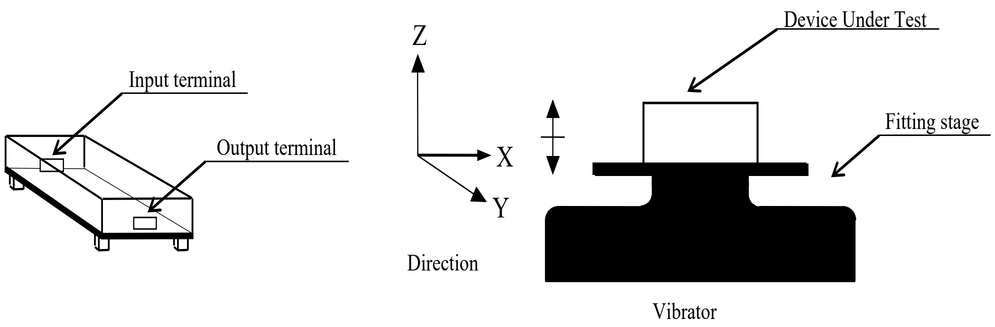
(2) Equipment Used

IMV CORP. : DC-3200-36

(3) Test Conditions

- Sweep frequency : 10～55Hz
- Direction : X, Y, Z
- Sweep time : 1.0min
- Sweep count : 1 hour each
- Acceleration : Constant 19.6m/s^2 (2G)

(4) Test Method



(5) Acceptable Conditions

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

(6) Test Results

Judgement : OK

7. Noise Simulate Test

MODEL : CUS1600M-12/24/36/48

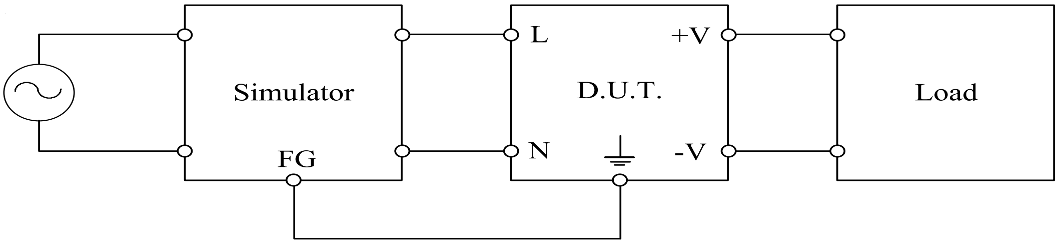
(1) Equipment Used

Simulator : INS-4040 (Noiseken)

Capacitive Coupling Adaptors : CA-805B

(2) Test Method and Device Test Point

Apply to (N, L, ⏚), (N, L), (N), (L), (⏚), (V+, V-), (STBY+, STBY-), (R+, R-), (S+, S-), (PG)



(3) Test Conditions

・Input voltage	: 100, 230VAC	・Noise level	: 0～2kV (Input Port) : 0～1kV (Output Port) : 0～1kV (Signal Port)
・Output voltage	: Rated		
・Output current	: 0%, 100%	・Standby current	: 0%, 100%
・Polarity	: ＋,－	・Mode	: Common, Normal (Input Port) : Common (Output Port) : Common (Signal Port)
・Ambient temperature	: 25℃		
・Pulse width	: 50～1000ns	・Trigger select	: Line
・Phase	: 0～360deg		

(4) Acceptable Conditions

1. The regulation of output voltage must not exceed 5% of initial value during test.

2. The output voltage must be within the regulation of specification after the test.

3. Smoke and fire are not allowed.

(5) Test Results

Judgement : OK

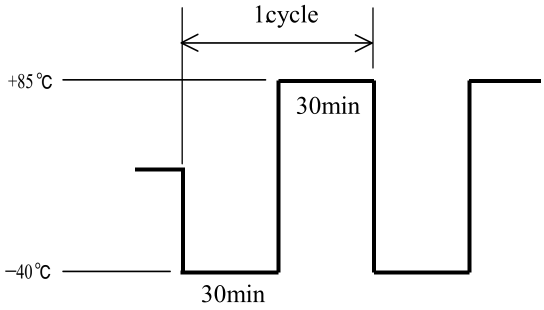
8. Thermal Shock Test

MODEL : CUS1600M-12

(1) Equipment Used (Thermal Shock Chamber)

Hitachi ES-107LH

(2) Test Conditions



- Ambient Temperature : -40℃ ⇔ 85℃
- Test Time : 30 min each temp.
- Test Cycle : 700 Cycles
- No Operating

(3) 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. 700 cycles later, leave it for 1 hour at the room temperature, then check if there is no abnormal output.

(4) Acceptable Conditions

No abnormal output after test.

(5) Test Results

Judgement : OK

9. FAN Life Expectancy

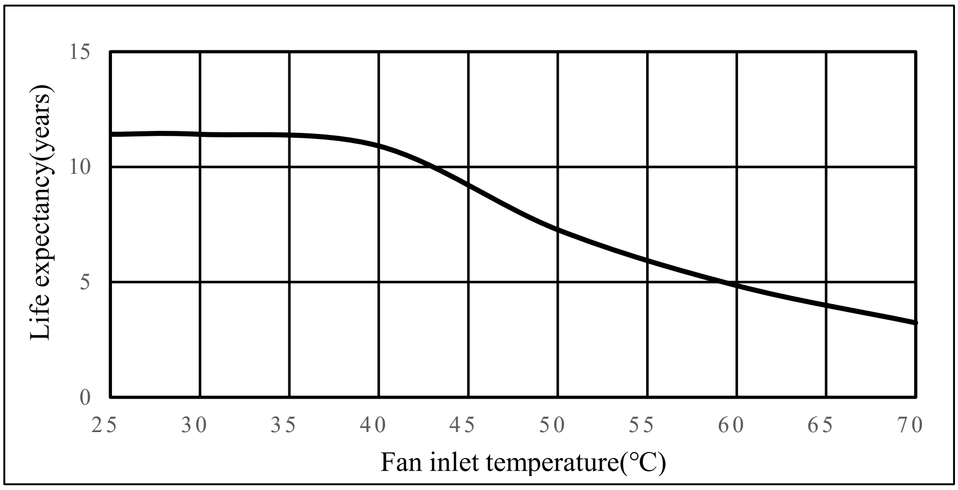
MODEL : CUS1600M-12

(1) Part Name

04020VA-12P-AA-08 (MINEBEA)

(2) Life Expectancy

The data shows fan life expectancy for fan only by manufacture (90% survival tate).
Fig.1 shows measuring point of fan inlet temperature.



Temperature(℃)	Life(years)
30	11.4
40	10.9
50	7.3
60	4.8
70	3.2

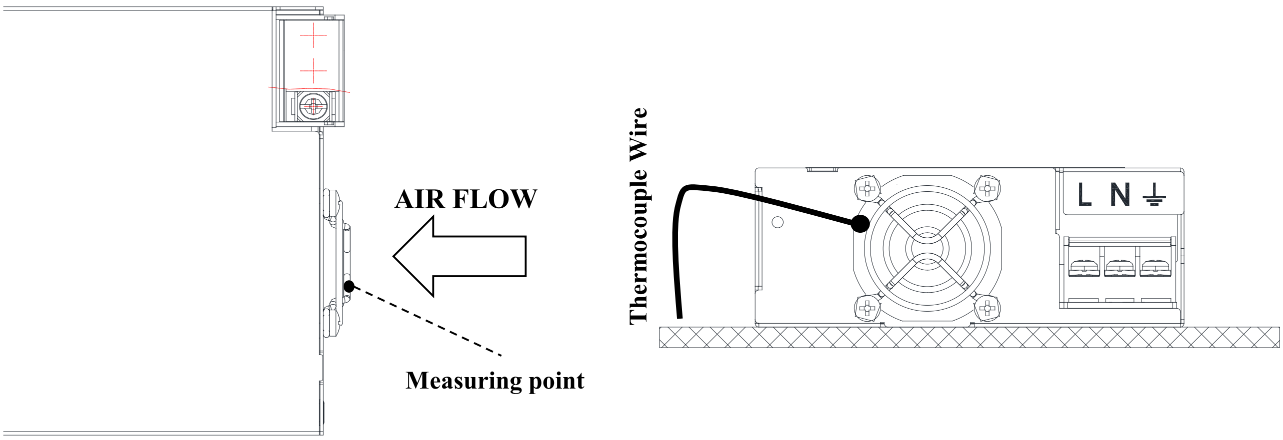


Fig.1 Measuring point of fan inlet temperature.