

MTW60-51212

RELIABILITY DATA

信頼性データ

I N D E X

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※ 試験結果は、代表データであります。全ての製品はほぼ同等な特性を示します。
従いまして、以下の結果は参考値とお考え願います。

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

1. MTBF計算値 Calculated Values of MTBF

MODEL : MTW60-51212

(1) 算出方法 Calculating Method

MIL-HDBK-217Fの部品ストレス解析法(*1)で算出されています。

故障率 λ_{SS} は、それぞれの部品ごとに電気ストレスと動作温度によって決定されます。

Calculated based on parts stress reliability projection of MIL-HDBK-217F (*1).

Individual failure rate λ_{SS} is calculated by the electric stress and temperature rise of the each device.

*1: MIL-HDBK-217F “Reliability Prediction of Electronic Equipment”
(MIL-HDBK-217F Notice 2 , 28, Feb., 1955 Issue)

<算出式>

$$MTBF = \frac{1}{\lambda_{equip}} = \frac{1}{\sum_{i=1}^m N_i \cdot \lambda_{SSi}} \times 10^6 \quad \text{時間 (hours)}$$

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

λ_{equip} : 全機器故障率 (FITs) Total Equipment failure rate (FITs = Failures in 10^6 hours)

λ_{Gi} : i番目の部品に対する基礎故障率 Generic failure rate for the ith device

π_{Qi} : i番目の部品に対する品質ファクタ Quality factor for the ith device

π_{Si} : i番目の部品に対するストレスファクタ Stress factor for the ith device

π_{Ti} : i番目の部品に対する温度ファクタ Temperature factor for the ith device

π_{Ei} : i番目の部品に対する環境ファクタ Environmental factor for the ith device

m : 異なる部品の数 Number of different device types

N_i : i番目の部品の個数 Quantity of ith device type

(2) MTBF値 MTBF Values

条件 Conditions :

Ta = 50°C

G_F : 地上、固定 (Ground, Fixed) = 57,559 時間 (Hours)

G_B : 地上、温和 (Ground, Benign) = 277,788 時間 (Hours)

Note : 電解コンデンサの寿命は、MTBF計算に含まれません。

Life expectancy of electrolytic capacitor are not included in MTBF calculation.

2. 部品ディレーティング Components Derating

MODEL : MTW60-51212

(1) 算出方法 Calculating Method

(a) 測定方法 Measuring method

| | | | | | | | | | | | | | |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|----|----|----|-----|------|------|-----------|------|------|------|
| ・ 取付方法 : 標準取付 : A Mounting method Standard mounting : A | ・ 周囲温度 : 50°C Ambient temperature | | | | | | | | | | | | |
| ・ 入力電圧 : 100 , 240VAC Input voltage | | | | | | | | | | | | | |
| ・ 出力電圧、電流 : Output voltage & current | <table border="1"> <tr> <td>出力</td> <td>V1</td> <td>V2</td> <td>V3</td> </tr> <tr> <td>負荷</td> <td>+5V</td> <td>+12V</td> <td>-12V</td> </tr> <tr> <td>Io = 100%</td> <td>5.0A</td> <td>2.5A</td> <td>0.5A</td> </tr> </table> | 出力 | V1 | V2 | V3 | 負荷 | +5V | +12V | -12V | Io = 100% | 5.0A | 2.5A | 0.5A |
| 出力 | V1 | V2 | V3 | | | | | | | | | | |
| 負荷 | +5V | +12V | -12V | | | | | | | | | | |
| Io = 100% | 5.0A | 2.5A | 0.5A | | | | | | | | | | |

(b) 半導体 Semiconductors

ケース温度、消費電力、熱抵抗より使用状態の接合点温度を求め最大定格、接合点温度との比較を求めました。

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

(c) IC、抵抗、コンデンサ等 IC, Resistors, Capacitors, etc.

周囲温度、使用状態、消費電力など、個々の値は設計基準内に入っています。
 Ambient temperature, operating condition, power dissipation and so on are within derating criteria.

(d) 熱抵抗算出方法 Calculating method of thermal impedance

$$\theta_{j-c} = \frac{T_j(\max) - T_c}{P_{ch}(\max)} \qquad \theta_{j-a} = \frac{T_j(\max) - T_a'}{P_{ch}(\max)}$$

Tc : ディレーティングの始まるケース温度 一般に25°C
 Case Temperature at Start Point of Derating ; 25°C in General

Ta' : ディレーティングの始まる周囲温度 一般に25°C
 Ambient Temperature at Start Point of Derating ; 25°C in General

Pch(max) : 最大チャネル損失
 Maximum Channel Dissipation

Tj(max) : 最大接合点(チャネル)温度
 (Tch(max)) Maximum Junction (channel) Temperature

θj-c : 接合点(チャネル)からケースまでの熱抵抗
 (θch-c) Thermal Impedance between Junction (channel) and Case

θj-a : 接合点(チャネル)から周囲までの熱抵抗
 (θch-a) Thermal Impedance between Junction (channel) and Ambient

(2) 部品ダイレーティング表 Components Derating List

| 部品番号 Location No. | $V_{in} = 100VAC$ | Load = 100% | $T_a = 50^\circ C$ |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------|
| Q1 TK6A60D TOSHIBA | $T_{ch}(\max) = 150^\circ C$ $P_{ch} = 1.34 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 99.5^\circ C$ D.F. = 66.3 % | $\theta_{ch-c} = 3.125^\circ C/W$ $\Delta T_c = 45.3^\circ C$ | $T_c = 95.3^\circ C$ |
| Q2 TK6A60D TOSHIBA | $T_{ch}(\max) = 150^\circ C$ $P_{ch} = 1.53 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 104.2^\circ C$ D.F. = 69.5 % | $\theta_{ch-c} = 3.125^\circ C/W$ $\Delta T_c = 49.4^\circ C$ | $T_c = 99.4^\circ C$ |
| CR2 RS405M RECTRON | $T_j(\max) = 150^\circ C$ $P_d = 1.48 W$ $T_{ch} = T_c + ((\theta_{j-c}) \times P_d) = 98.0^\circ C$ D.F. = 65.3 % | $\theta_{j-c} = 6.0^\circ C/W$ $\Delta T_c = 39.1^\circ C$ | $T_c = 89.1^\circ C$ |
| CR51 STPS20H100CFP STMICRO | $T_j(\max) = 175^\circ C$ $P_d = 4.47 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 131.8^\circ C$ D.F. = 75.3 % | $\theta_{j-c} = 3.2^\circ C/W$ $\Delta T_c = 67.5^\circ C$ | $T_c = 117.5^\circ C$ |
| CR53 STPS20150CFP STMICRO | $T_j(\max) = 175^\circ C$ $P_d = 2.41 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 119.5^\circ C$ D.F. = 68.3 % | $\theta_{j-c} = 3.5^\circ C/W$ $\Delta T_c = 61.1^\circ C$ | $T_c = 111.1^\circ C$ |
| CR55 YG911S3R FUJI ELECTRIC | $T_j(\max) = 150^\circ C$ $P_d = 0.52 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 107.5^\circ C$ D.F. = 71.7 % | $\theta_{j-c} = 3.5^\circ C/W$ $\Delta T_c = 55.7^\circ C$ | $T_c = 105.7^\circ C$ |
| IC1 ICE3BS03LJG INFINEON | $T_j(\max) = 150^\circ C$ $P_d = 103 mW$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 78.7^\circ C$ D.F. = 52.5 % | $\theta_{j-c} = 5.3^\circ C/W$ $\Delta T_c = 28.2^\circ C$ | $T_c = 78.2^\circ C$ |
| IC2 TLP785F TOSHIBA (LED) | $T_{ch}(\max) = 125^\circ C$ $P_d = 13.8 mW$ $T_{ch} = T_c + ((\theta_{ch-a}) \times P_d) = 83.7^\circ C$ D.F. = 66.9 % | $\theta_{ch-a} = 1111.1^\circ C/W$ $\Delta T_c = 18.3^\circ C$ | $T_c = 68.3^\circ C$ |
| IC2 TLP785F TOSHIBA (TRANSISTOR) | $T_{ch}(\max) = 125^\circ C$ $P_c = 1.62 mW$ $T_{ch} = T_c + ((\theta_{ch-a}) \times P_c) = 69.4^\circ C$ D.F. = 55.5 % | $\theta_{ch-a} = 666.7^\circ C/W$ $\Delta T_c = 18.3^\circ C$ | $T_c = 68.3^\circ C$ |

| 部品番号 Location No. | $V_{in} = 240VAC$ | Load = 100% | $T_a = 50^\circ C$ |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------|
| Q1 TK6A60D TOSHIBA | $T_{ch} (max) = 150^\circ C$ $P_{ch} = 1.34 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 118.8^\circ C$ D.F. = 79.2 % | $\theta_{ch-c} = 3.125^\circ C/W$ $\Delta T_c = 64.6^\circ C$ | $T_c = 114.6^\circ C$ |
| Q2 TK6A60D TOSHIBA | $T_{ch} (max) = 150^\circ C$ $P_{ch} = 1.53 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 122.4^\circ C$ D.F. = 81.6 % | $\theta_{ch-c} = 3.125^\circ C/W$ $\Delta T_c = 67.6^\circ C$ | $T_c = 117.6^\circ C$ |
| CR2 RS405M RECTRON | $T_j (max) = 150^\circ C$ $P_d = 0.79 W$ $T_{ch} = T_c + ((\theta_{j-c}) \times P_d) = 74.9^\circ C$ D.F. = 50.0 % | $\theta_{j-c} = 6.0^\circ C/W$ $\Delta T_c = 20.2^\circ C$ | $T_c = 70.2^\circ C$ |
| CR51 STPS20H100CFP STMICRO | $T_j (max) = 175^\circ C$ $P_d = 4.46 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 131.6^\circ C$ D.F. = 75.2 % | $\theta_{j-c} = 3.2^\circ C/W$ $\Delta T_c = 67.3^\circ C$ | $T_c = 117.3^\circ C$ |
| CR53 STPS20150CFP STMICRO | $T_j (max) = 175^\circ C$ $P_d = 2.42 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 119.8^\circ C$ D.F. = 68.4 % | $\theta_{j-c} = 3.5^\circ C/W$ $\Delta T_c = 61.3^\circ C$ | $T_c = 111.3^\circ C$ |
| CR55 YG911S3R FUJI ELECTRIC | $T_j (max) = 150^\circ C$ $P_d = 0.51 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 109.1^\circ C$ D.F. = 72.7 % | $\theta_{j-c} = 3.5^\circ C/W$ $\Delta T_c = 57.3^\circ C$ | $T_c = 107.3^\circ C$ |
| IC1 ICE3BS03LJG INFINEON | $T_j (max) = 150^\circ C$ $P_d = 134 mW$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 83.5^\circ C$ D.F. = 55.7 % | $\theta_{j-c} = 5.3^\circ C/W$ $\Delta T_c = 32.8^\circ C$ | $T_c = 82.8^\circ C$ |
| IC2 TLP785F TOSHIBA (LED) | $T_{ch} (max) = 125^\circ C$ $P_d = 13.8 mW$ $T_{ch} = T_c + ((\theta_{ch-a}) \times P_d) = 85.6^\circ C$ D.F. = 68.5 % | $\theta_{ch-a} = 1111.1^\circ C/W$ $\Delta T_c = 20.2^\circ C$ | $T_c = 70.2^\circ C$ |
| IC2 TLP785F TOSHIBA (TRANSISTOR) | $T_{ch} (max) = 125^\circ C$ $P_c = 1.62 mW$ $T_{ch} = T_c + ((\theta_{ch-a}) \times P_c) = 71.3^\circ C$ D.F. = 57.0 % | $\theta_{ch-a} = 666.7^\circ C/W$ $\Delta T_c = 20.2^\circ C$ | $T_c = 70.2^\circ C$ |

3. 主要部品温度上昇値 Main Components Temperature Rise ΔT List

MODEL : MTW60-51212

(1) 測定条件 Measuring Conditions

| | | | |
|----------------------------------------------------------------------|-----------------|--------|--------|
| 取付方法 Mounting Method (標準取付 : A) (Standard Mounting : A) | | | |
| 入力電圧 V_{in} Input Voltage | 100VAC / 240VAC | | |
| 出力電圧 V_o Output Voltage | V1 | V2 | V3 |
| | +5VDC | +12VDC | -12VDC |
| 出力電流 I_o (100%) Output Current | 5.0A | 2.5A | 0.5A |

(2) 測定結果 Measuring Results

| 入力電圧 Input Voltage 周囲温度 Ambient temperature | | ΔT Temperature Rise ($^{\circ}C$) | |
|------------------------------------------------|---------------|---------------------------------------------|-------------------|
| | | $V_{in} = 100VAC$ | $V_{in} = 240VAC$ |
| 部品番号 Location No. 部品名 Part name | | 取付方向 Mounting A | |
| Q1 | MOS FET | 45.3 | 64.6 |
| Q2 | MOS FET | 49.4 | 67.6 |
| CR2 | BRIDGE DIODE | 39.1 | 20.2 |
| CR51 | DIODE | 67.5 | 67.3 |
| CR53 | DIODE | 61.1 | 61.3 |
| CR55 | DIODE | 55.7 | 57.3 |
| IC1 | IC | 28.2 | 32.8 |
| IC2 | PHOTO COUPLER | 18.3 | 20.2 |
| IC3 | IC | 25.5 | 26.2 |
| IC4 | PHOTO COUPLER | 21.5 | 20.9 |
| IC55 | IC | 65.6 | 65.7 |
| T1 | TRANS | 39.1 | 41.9 |
| T2 | TRANS | 41.8 | 45.2 |
| L1 | BALUN | 30.0 | 19.2 |
| L51 | CHOKER COIL | 26.0 | 25.7 |
| C5 | E.CAP. | 17.9 | 14.2 |
| C9 | E.CAP. | 25.2 | 32.4 |
| C12 | E.CAP. | 21.3 | 20.0 |
| C16 | E.CAP. | 27.1 | 30.4 |
| C52 | E.CAP. | 37.7 | 36.6 |
| C53 | E.CAP. | 34.7 | 33.9 |
| C60 | E.CAP. | 38.3 | 38.4 |
| C65 | E.CAP. | 39.3 | 40.1 |
| C66 | E.CAP. | 38.8 | 39.0 |

4. 電解コンデンサ推定寿命計算値

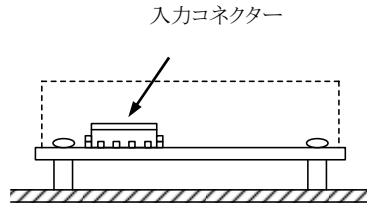
Electrolytic Capacitor Lifetime

MODEL : MTW60-51212

空冷条件 : 自然空冷

Cooling condition : Convection cooling

取付方向 A
Mounting A

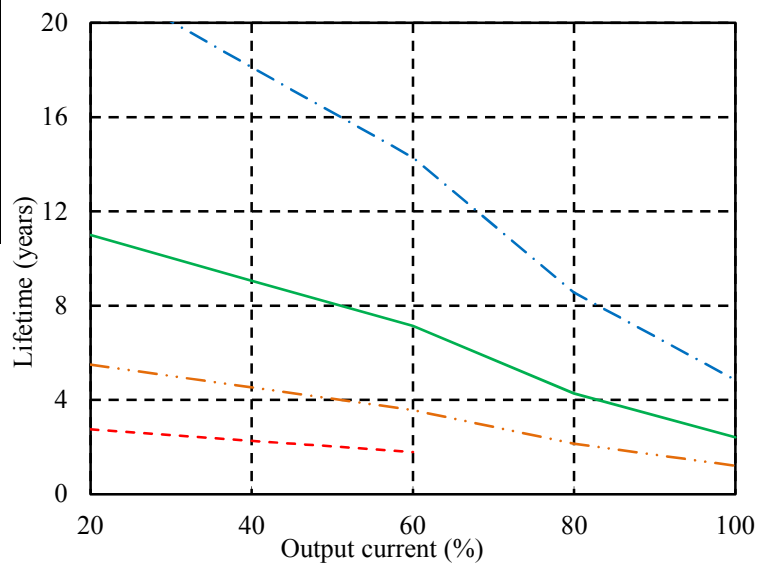


Conditions

Ta : 30°C : -.-.-
40°C : ———
50°C : -.-.-
60°C : -.-.-

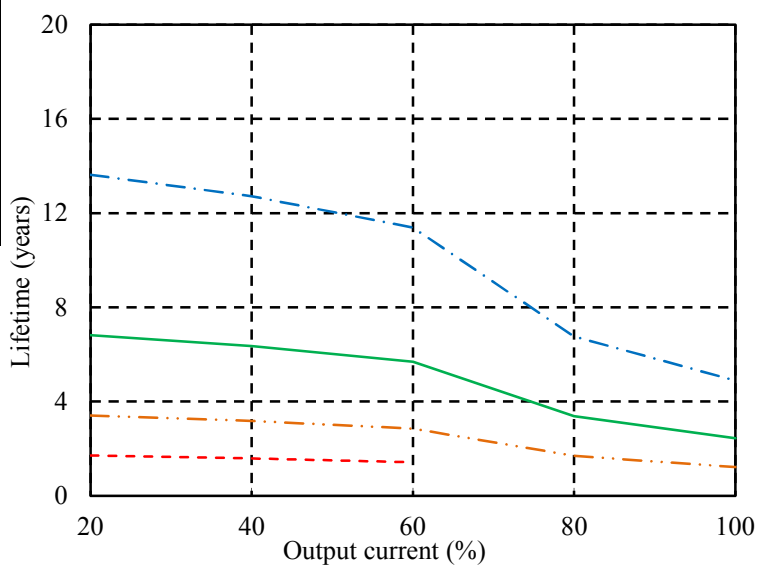
Vin = 100VAC

| Load \ Ta | Lifetime (years) | | | |
|-----------|------------------|------|------|------|
| | 30°C | 40°C | 50°C | 60°C |
| 20% | 20.0 | 11.0 | 5.5 | 2.8 |
| 40% | 18.1 | 9.1 | 4.5 | 2.3 |
| 60% | 14.3 | 7.1 | 3.6 | 1.8 |
| 80% | 8.6 | 4.3 | 2.1 | - |
| 100% | 4.8 | 2.4 | 1.2 | - |



Vin = 240VAC

| Load \ Ta | Lifetime (years) | | | |
|-----------|------------------|------|------|------|
| | 30°C | 40°C | 50°C | 60°C |
| 20% | 13.6 | 6.8 | 3.4 | 1.7 |
| 40% | 12.7 | 6.4 | 3.2 | 1.6 |
| 60% | 11.4 | 5.7 | 2.9 | 1.4 |
| 80% | 6.8 | 3.4 | 1.7 | - |
| 100% | 4.9 | 2.4 | 1.2 | - |



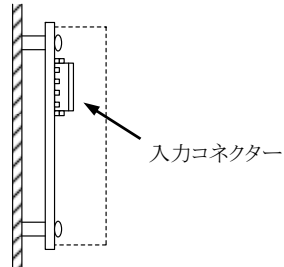
上記推定寿命は、弊社計算方法により算出した値であり、封ロゴムの劣化などの影響を含めておりません。
The lifetime is calculated based on our method and doesn't include the seal rubber degradation effect etc.
電解コンデンサの寿命は15年が上限となります。
The upper limit of the Electrolytic Capacitors lifetime are 15 years.

MODEL : MTW60-51212

空冷条件 : 自然空冷

Cooling condition : Convection cooling

取付方向 C
Mounting C

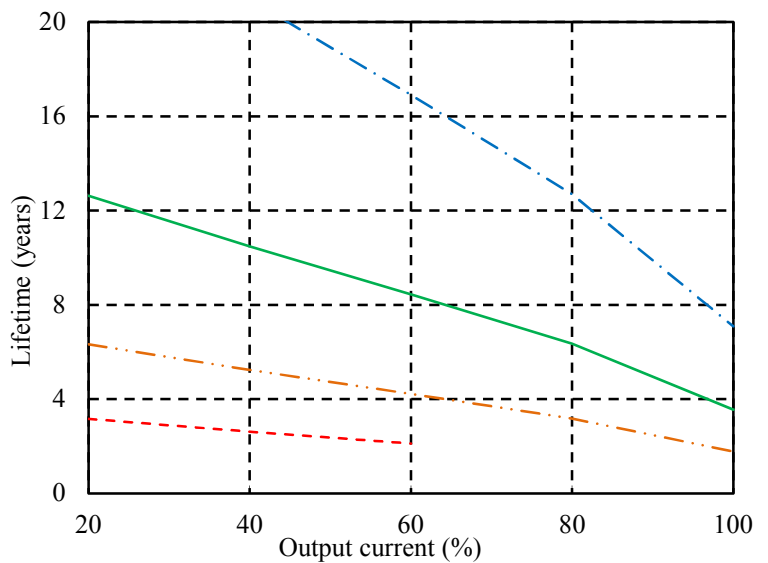


Conditions

Ta : 30°C : — — — —
40°C : — — — —
50°C : - - - -
60°C : - - - -

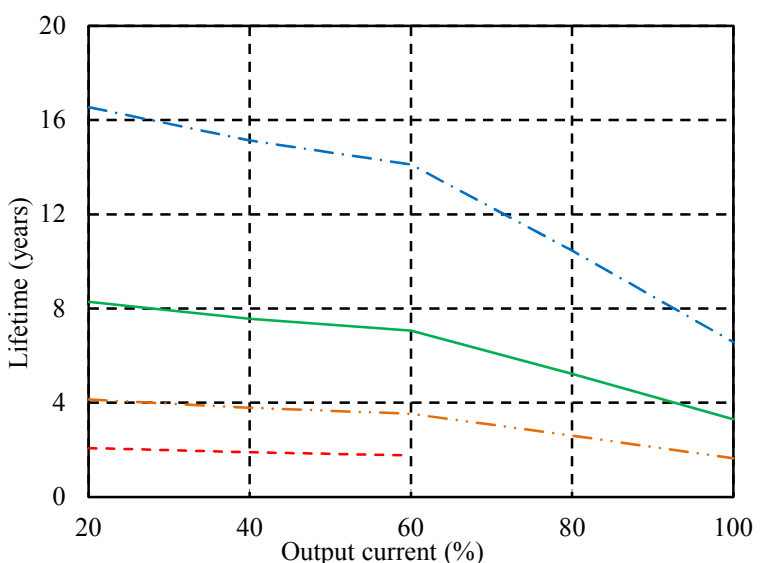
Vin = 100VAC

| Load \ Ta | Lifetime (years) | | | |
|-----------|------------------|------|------|------|
| | 30°C | 40°C | 50°C | 60°C |
| 20% | 20.0 | 12.6 | 6.3 | 3.2 |
| 40% | 20.0 | 10.5 | 5.2 | 2.6 |
| 60% | 16.9 | 8.5 | 4.2 | 2.1 |
| 80% | 12.7 | 6.4 | 3.2 | - |
| 100% | 7.1 | 3.6 | 1.8 | - |



Vin = 240VAC

| Load \ Ta | Lifetime (years) | | | |
|-----------|------------------|------|------|------|
| | 30°C | 40°C | 50°C | 60°C |
| 20% | 16.6 | 8.3 | 4.1 | 2.1 |
| 40% | 15.1 | 7.6 | 3.8 | 1.9 |
| 60% | 14.1 | 7.1 | 3.5 | 1.8 |
| 80% | 10.5 | 5.2 | 2.6 | - |
| 100% | 6.6 | 3.3 | 1.6 | - |



上記推定寿命は、弊社計算方法により算出した値であり、封ロゴムの劣化などの影響を含めておりません。
The lifetime is calculated based on our method and doesn't include the seal rubber degradation effect etc.
電解コンデンサの寿命は15年が上限となります。

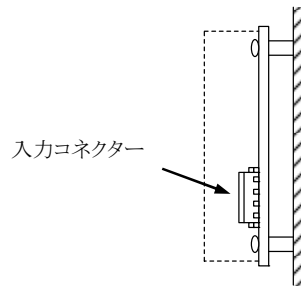
The upper limit of the Electrolytic Capacitors lifetime are 15 years.

MODEL : MTW60-51212

空冷条件 : 自然空冷

Cooling condition : Convection cooling

取付方向 D
Mounting D

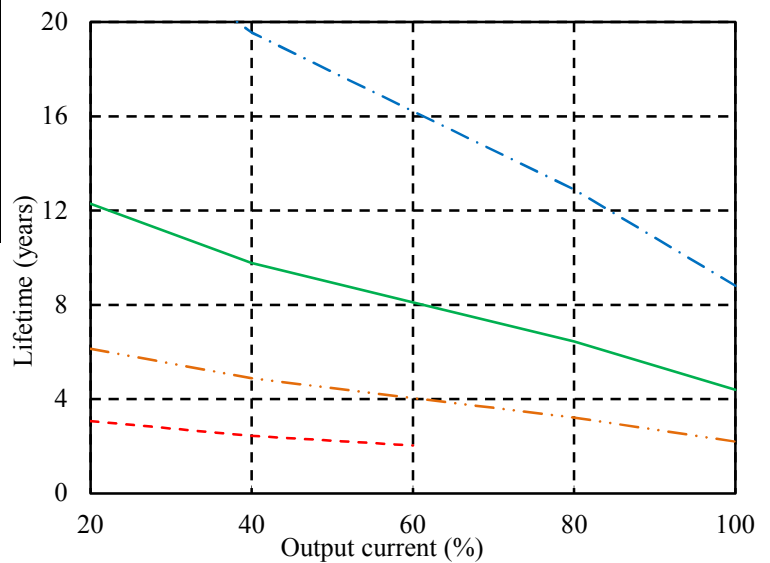


Conditions

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

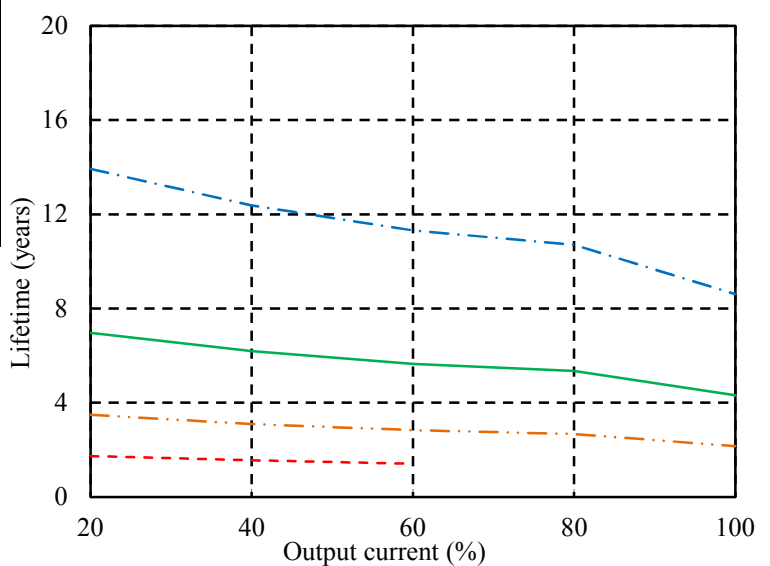
Vin = 100VAC

| Load \ Ta | Lifetime (years) | | | |
|-----------|------------------|------|------|------|
| | 30°C | 40°C | 50°C | 60°C |
| 20% | 20.0 | 12.3 | 6.1 | 3.1 |
| 40% | 19.6 | 9.8 | 4.9 | 2.4 |
| 60% | 16.2 | 8.1 | 4.1 | 2.0 |
| 80% | 12.9 | 6.5 | 3.2 | - |
| 100% | 8.8 | 4.4 | 2.2 | - |



Vin = 240VAC

| Load \ Ta | Lifetime (years) | | | |
|-----------|------------------|------|------|------|
| | 30°C | 40°C | 50°C | 60°C |
| 20% | 13.9 | 7.0 | 3.5 | 1.7 |
| 40% | 12.4 | 6.2 | 3.1 | 1.6 |
| 60% | 11.3 | 5.7 | 2.8 | 1.4 |
| 80% | 10.7 | 5.4 | 2.7 | - |
| 100% | 8.6 | 4.3 | 2.2 | - |



上記推定寿命は、弊社計算方法により算出した値であり、封ロゴムの劣化などの影響を含めておりません。
The lifetime is calculated based on our method and doesn't include the seal rubber degradation effect etc.
電解コンデンサの寿命は15年が上限となります。

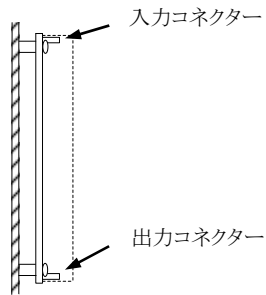
The upper limit of the Electrolytic Capacitors lifetime are 15 years.

MODEL : MTW60-51212

空冷条件 : 自然空冷

Cooling condition : Convection cooling

取付方向 E
Mounting E

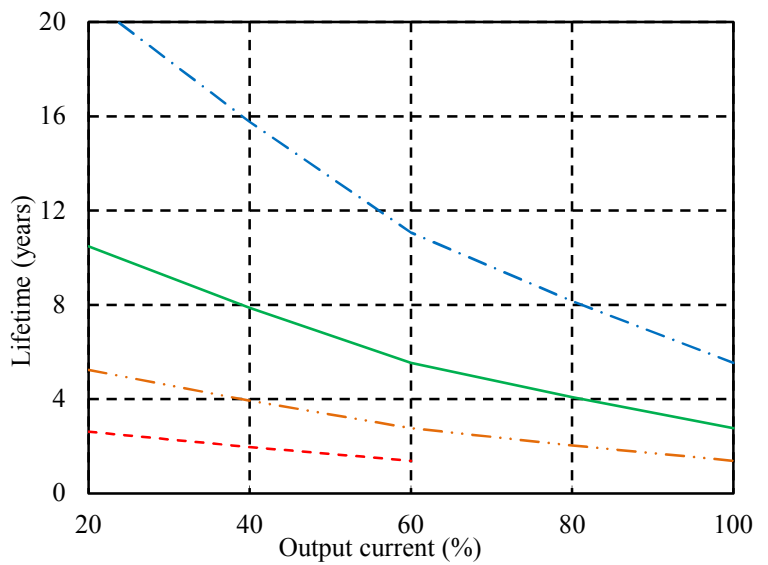


Conditions

Ta : 30°C : — — — —
40°C : — — — —
50°C : - - - -
60°C : - - - -

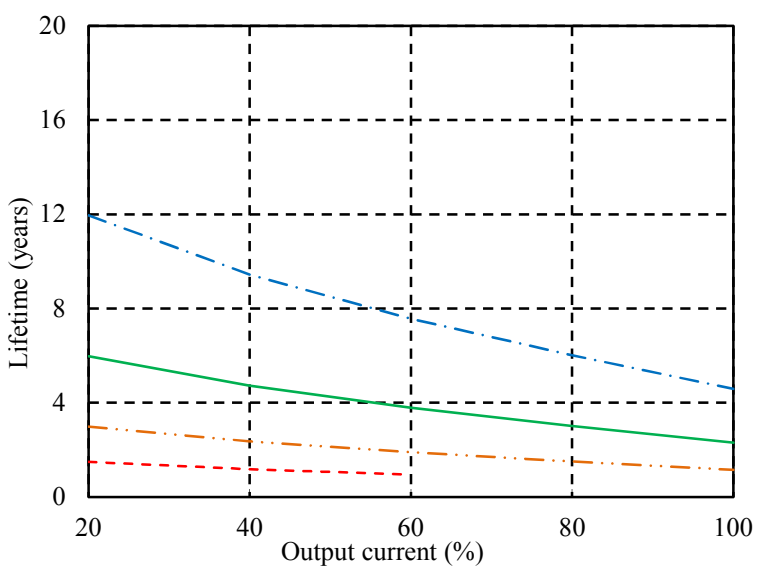
Vin = 100VAC

| Load \ Ta | Lifetime (years) | | | |
|-----------|------------------|------|------|------|
| | 30°C | 40°C | 50°C | 60°C |
| 20% | 20.0 | 10.5 | 5.2 | 2.6 |
| 40% | 15.8 | 7.9 | 3.9 | 2.0 |
| 60% | 11.1 | 5.5 | 2.8 | 1.4 |
| 80% | 8.2 | 4.1 | 2.0 | - |
| 100% | 5.5 | 2.8 | 1.4 | - |



Vin = 240VAC

| Load \ Ta | Lifetime (years) | | | |
|-----------|------------------|------|------|------|
| | 30°C | 40°C | 50°C | 60°C |
| 20% | 12.0 | 6.0 | 3.0 | 1.5 |
| 40% | 9.4 | 4.7 | 2.4 | 1.2 |
| 60% | 7.6 | 3.8 | 1.9 | 1.0 |
| 80% | 6.0 | 3.0 | 1.5 | - |
| 100% | 4.6 | 2.3 | 1.2 | - |



上記推定寿命は、弊社計算方法により算出した値であり、封ロゴムの劣化などの影響を含めておりません。
The lifetime is calculated based on our method and doesn't include the seal rubber degradation effect etc.
電解コンデンサの寿命は15年が上限となります。

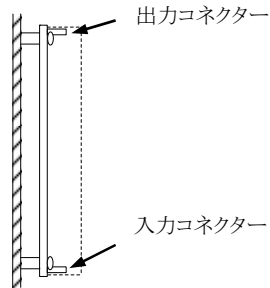
The upper limit of the Electrolytic Capacitors lifetime are 15 years.

MODEL : MTW60-51212

空冷条件 : 自然空冷

Cooling condition : Convection cooling

取付方向 F
Mounting F

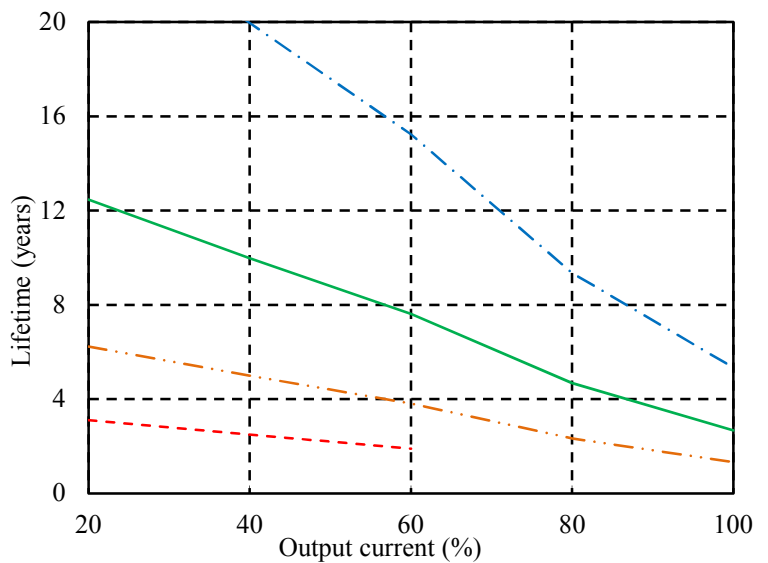


Conditions

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

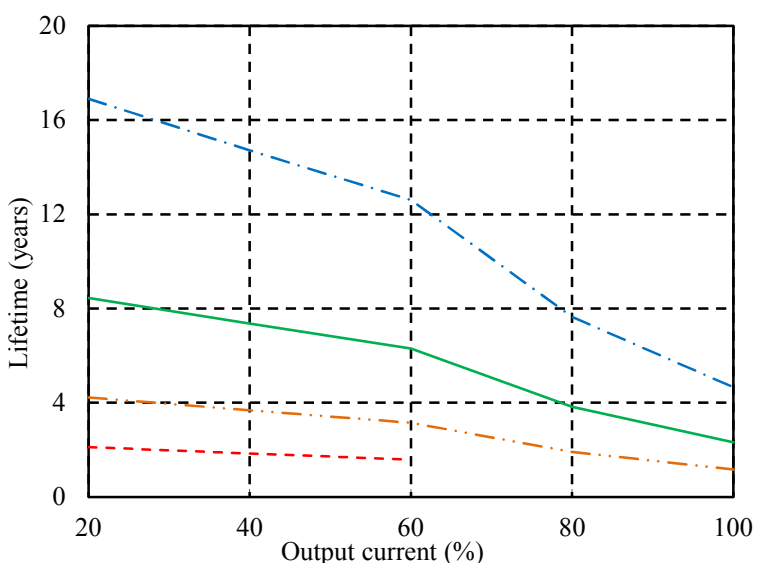
Vin = 100VAC

| Load \ Ta | Lifetime (years) | | | |
|-----------|------------------|------|------|------|
| | 30°C | 40°C | 50°C | 60°C |
| 20% | 20.0 | 12.5 | 6.2 | 3.1 |
| 40% | 20.0 | 10.0 | 5.0 | 2.5 |
| 60% | 15.2 | 7.6 | 3.8 | 1.9 |
| 80% | 9.4 | 4.7 | 2.3 | - |
| 100% | 5.3 | 2.7 | 1.3 | - |



Vin = 240VAC

| Load \ Ta | Lifetime (years) | | | |
|-----------|------------------|------|------|------|
| | 30°C | 40°C | 50°C | 60°C |
| 20% | 16.9 | 8.5 | 4.2 | 2.1 |
| 40% | 14.7 | 7.4 | 3.7 | 1.8 |
| 60% | 12.6 | 6.3 | 3.2 | 1.6 |
| 80% | 7.7 | 3.8 | 1.9 | - |
| 100% | 4.7 | 2.3 | 1.2 | - |



上記推定寿命は、弊社計算方法により算出した値であり、封ロゴムの劣化などの影響を含めておりません。
The lifetime is calculated based on our method and doesn't include the seal rubber degradation effect etc.
電解コンデンサの寿命は15年が上限となります。

The upper limit of the Electrolytic Capacitors lifetime are 15 years.

5. アブノーマル試験 Abnormal Test

MODEL : MTW60-51212

(1) 試験条件 Test Conditions

Input : 255V Output : 5/12/-12V , 5.0A/2.5A/0.5A(100%) Ta : 25°C 70%RH

(2) 試験結果 Test Results

(Da : Damaged)

| No. | Test position | | Test mode | | Test result | | | | | | | | | | | 記事 Note | |
|-----|-----------------------|--------------------|---------------|--------------|-----------------|------------------|------------------|------------------|--------------------|--------------------|--------------------------|----------|----------|-----------------------|------------------------|------------|---------------------------------------------------------|
| | 部品No. Location No. | 試験端子 Test point | ショート Short | オープン Open | a 発火 Fire | b 発煙 Smoke | c 破裂 Burst | d 異臭 Smell | e 赤熱 Red hot | f 破損 Damaged | g ヒューズ断 Fuse blown | h OVP | I OCP | j 出力断 No output | k 変化なし No change | | l その他 Others |
| 1 | Q1 | D-G | ○ | | | | | | | ○ | ○ | | | | | | FUSE : F1 Da : Q1, CR9 V1出力断 V1 No output |
| 2 | | D-S | ○ | | | | | | | ○ | ○ | | | | | | FUSE : F1 Da : CR9 V1出力断 V1 No output |
| 3 | | G-S | ○ | | | | | | | | | | | ○ | | | V1出力断 V1 No output |
| 4 | | D | | ○ | | | | | | | | | | ○ | | | V1出力断 V1 No output |
| 5 | | G | | ○ | | | | | | | | | | ○ | | | V1出力断 V1 No output |
| 6 | | S | | ○ | | | | | | | | | | ○ | | | V1出力断 V1 No output |
| 7 | Q2 | D-G | ○ | | | | | | | ○ | ○ | | | | | | FUSE : F1 Da : Q2, CR10 V2,3出力断 V2,3 No output |
| 8 | | D-S | ○ | | | | | | | ○ | ○ | | | | | | FUSE : F1 Da : CR10 V2,3出力断 CH2,3 No output |
| 9 | | G-S | ○ | | | | | | | | | | | ○ | | | V2,3出力断 CH2,3 No output |
| 10 | | D | | ○ | | | | | | | | | | ○ | | | V2,3出力断 CH2,3 No output |
| 11 | | G | | ○ | | | | | | | | | | ○ | | | V2,3出力断 CH2,3 No output |
| 12 | | S | | ○ | | | | | | | | | | ○ | | | V2,3出力断 CH2,3 No output |

| No. | Test position | | Test mode | | Test result | | | | | | | | | | | 記事 Note | |
|-----|-----------------------|--------------------|---------------|--------------|-----------------|------------------|------------------|------------------|--------------------|--------------------|--------------------------|----------|----------|-----------------------|------------------------|------------------------------|--------------------|
| | 部品No. Location No. | 試験端子 Test point | ショート Short | オープン Open | a 発火 Fire | b 発煙 Smoke | c 破裂 Burst | d 異臭 Smell | e 赤熱 Red hot | f 破損 Damaged | g ヒューズ断 Fuse blown | h OVP | I OCP | j 出力断 No output | k 変化なし No change | | l その他 Others |
| 13 | CR2 | AC-DC | ○ | | | | | | | | ○ | | | ○ | | FUSE:F1 | |
| 14 | | DC-DC | ○ | | | | | | | | ○ | | | ○ | | FUSE:F1 | |
| 15 | | AC-AC | ○ | | | | | | | | ○ | | | ○ | | FUSE:F1 | |
| 16 | | AC | | ○ | | | | | | | | | | | ○ | | |
| 17 | | DC | | ○ | | | | | | | | | | | ○ | | |
| 18 | CR51 | A-K | ○ | | | | | | | | | | | ○ | | V1出力断 V1 No output | |
| 19 | | A/K | | ○ | | | | | | | | | | ○ | | V1出力断 V1 No output | |
| 20 | CR53 | A-K | ○ | | | | | | | | | | | ○ | | V2,3出力断 V2,3 No output | |
| 21 | | A/K | | ○ | | | | | | | | | | ○ | | V2,3出力断 No output | |
| 22 | CR55 | A-K | ○ | | | | | | | | | | | ○ | | V2,3出力断 V2,3 No output | |
| 23 | | A/K | | ○ | | | | | | | | | | ○ | | V3出力断 V3 No output | |
| 24 | IC51 | A-K | ○ | | | | | | | | | | | | ○ | V1出力低下 V1 Output decrease | |
| 25 | | A-Ref | ○ | | | | | | | | | | | | ○ | V1出力上昇 V1 Output increase | |
| 26 | | A | | ○ | | | | | | | | ○ | | | | V1出力断 V1 No output | |
| 27 | | K | | ○ | | | | | | | | ○ | | | | V1出力断 V1 No output | |
| 28 | | Ref | | ○ | | | | | | | | ○ | | | | V1出力断 V1 No output | |
| 29 | IC55 | 1-2 | ○ | | | | | | | | | | | ○ | | V2,3出力断 V2,3 No output | |
| 30 | | 2-3 | ○ | | | | | | | | | | | | ○ | V3出力上昇 V3 Output increase | |
| 31 | | 1 | | ○ | | | | | | | | | | ○ | | V3出力断 V3 No output | |
| 32 | | 2 | | ○ | | | | | | | | | | ○ | | V3出力断 V3 No output | |
| 33 | | 3 | | ○ | | | | | | | | | | ○ | | V3出力断 V3 No output | |

6. 振動試験 Vibration Test

MODEL : MTW60-51212

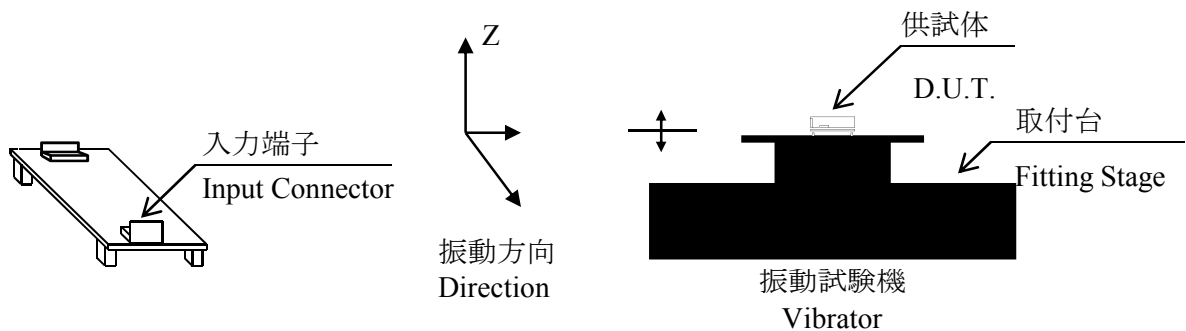
(1) 振動試験種類 Vibration Test Class

掃引振動数耐久試験 Frequency variable endurance test

(2) 試験条件 Test Conditions

| | | | |
|---------------------------|-----------------|----------------------|--------------------------------------------|
| ・周波数範囲 Sweep frequency | : 5~10Hz | ・全振幅 Amplitude | : 10mm P-P |
| ・周波数範囲 Sweep frequency | : 10~200Hz | ・加速度 Acceleration | : 一定 19.6m/s ² (2G) Constant |
| ・振動方向 Direction | : X, Y, Z | | |
| ・掃引時間 Sweep time | : 10分間 10min | ・試験時間 Sweep count | : 各方向共 1時間 1 hour each |

(3) 試験方法 Test Method



(5) 判定条件 Acceptable Conditions

1. 破壊しない事
Not to be broken.
2. 試験後の出力に異常がない事
No abnormal output after test.

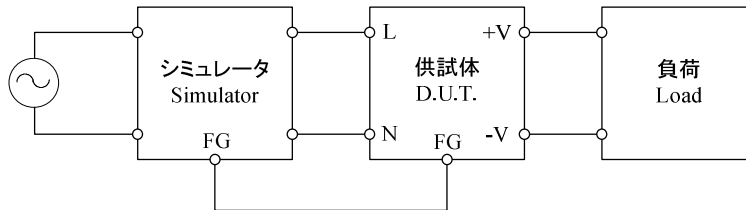
(6) 試験結果 Test Results

合格 OK

7. ノイズシミュレート試験 Noise Simulate Test

MODEL : MTW60-51212

(1) 試験回路及び測定器 Test Circuit and Equipment



シミュレータ : INS-4320(A) (ノイズ研究所)
 Simulator (Noise Laboratory Co.,LTD)

(2) 試験条件 Test Conditions

| | | | |
|------------------------------|---------------|--------------------------|------------------------------|
| ・入力電圧 Input voltage | : 100, 230VAC | ・ノイズ電圧 Noise level | : 0~2kV |
| ・出力電圧 Output Voltage | : 定格 Rated | ・位相 Phase | : 0~360 deg |
| ・出力電流 Output current | : 0, 100% | ・極性 Polarity | : +, - |
| ・周囲温度 Ambient temperature | : 25°C | ・印加モード Mode | : コモン、ノーマル Common, Normal |
| ・パルス幅 Pulse width | : 50~1000ns | ・トリガ選択 Trigger select | : Line |

(3) 判定条件 Acceptable Conditions

1. 試験中、5%を超える出力電圧の変動のない事
 The regulation of output voltage must not exceed 5% of initial value during test.
2. 試験後の出力電圧は初期値から変動していない事
 The output voltage must be within the regulation of specification after the test.
3. 発煙・発火のない事
 Smoke and fire are not allowed.

(4) 試験結果 Test Results

合格 OK