

EZA11K-320240

RELIABILITY DATA

信頼性データ

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※当社測定条件における結果であり、参考値としてお考え願います。

The results are reference data based on our measurement condition.

1. MTBF計算値 Calculated Values of MTBF

MODEL : EZA11K-320240

算出方法 Calculating method

JEITA (RCR-9102B) の部品点数法で算出されています。

それぞれの部品ごとに、部品故障率 λ_G が与えられ、各々の点数によって決定されます。

Calculated based on part count reliability prediction of JEITA (RCR-9102B).

Individual failure rates λ_G is given to each part and MTBF is calculated by the count of each part.

<算出式>

$$MTBF = \frac{1}{\lambda_{equip}} \times 10^6 = \frac{1}{\sum_{i=1}^n n_i (\lambda_G \pi_Q)_i} \times 10^6 \text{ 時間 (Hours)}$$

λ_{equip} : 全機器故障率 (故障数 / 10^6 時間)
Total equipment failure rate (Failure / 10^6 Hours)

λ_G : i 番目の同属部品に対する故障率 (故障数 / 10^6 時間)
Generic failure rate for the ith generic part (Failure / 10^6 Hours)

n_i : i 番目の同属部品の個数
Quantity of ith generic part

n : 異なった同属部品のカテゴリの数
Number of different generic part categories

π_Q : i 番目の同属部品に対する品質ファクタ ($\pi_Q=1$)
Generic quality factor for the ith generic part ($\pi_Q=1$)

MTBF値 MTBF values

G_F : 地上、固定 (Ground, Fixed)

RCR-9102B

$$MTBF \approx \underline{\hspace{2cm}} 10,775 \text{ 時間 (Hours)}$$

MTBFの計算にファンは含まれておりません。

MTBF calculation for fan is not included.

2. 部品ディレーティング Components Derating

MODEL : EZA11K-320240

(1) 算出方法 Calculating method

(a) 測定方法 Measuring method

取付方法 Mounting method	標準取付 Standard mounting	
周囲温度 Ambient temperature	50°C	
電力変換方向 Power conversion direction	力行 Generation mode	回生 Regeneration mode
入力電圧 Input voltage	320VDC	240VDC
出力電圧、電流 Output voltage & current	240VDC, 45.8A(100%)	320VDC, 34.4A(100%)

(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

$$\theta_{j-c} = \frac{T_j(\text{max}) - T_c}{P_{ch}(\text{max})}$$

T_c : 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

$P_j(\text{max})$: 最大接合点(チャネル)損失
 $(P_{ch}(\text{max}))$ Maximum junction (channel) dissipation

$T_j(\text{max})$: 最大接合点(チャネル)温度
 $(T_{ch}(\text{max}))$ Maximum junction (channel) temperature

θ_{j-c} : 接合点(チャネル)からケースまでの熱抵抗
 (θ_{ch-c}) Thermal impedance between junction (channel) and case

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

(2.1) 力行 Generation mode

部品番号 Location No.	$V_{in} = 320VDC$	$V_o = 240VDC$	Load = 100%	$T_a = 50^{\circ}C$
Q41 MOS FET	Tch (max) = 150 °C Pch = 8.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 70.4 °C D.F. = 46.9 %		$\theta_{ch-c} = 0.28^{\circ}C/W$ $\Delta Tc = 18.0^{\circ}C$	Tc= 68.0 °C
Q105 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 69.5 °C D.F. = 39.7 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta Tc = 9.5^{\circ}C$	Tc= 59.5 °C
Q107 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 71.0 °C D.F. = 40.5 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta Tc = 11.0^{\circ}C$	Tc= 61.0 °C
Q109 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 71.2 °C D.F. = 40.7 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta Tc = 11.2^{\circ}C$	Tc= 61.2 °C
Q111 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 73.7 °C D.F. = 42.1 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta Tc = 13.7^{\circ}C$	Tc= 63.7 °C
Q113 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 72.4 °C D.F. = 41.3 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta Tc = 12.4^{\circ}C$	Tc= 62.4 °C
Q115 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 74.4 °C D.F. = 42.5 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta Tc = 14.4^{\circ}C$	Tc= 64.4 °C
Q152 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 69.9 °C D.F. = 39.9 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta Tc = 9.9^{\circ}C$	Tc= 59.9 °C
Q154 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 71.0 °C D.F. = 40.5 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta Tc = 11.0^{\circ}C$	Tc= 61.0 °C

部品番号 Location No.	$V_{in} = 320VDC$	$V_o = 240VDC$	Load = 100%	$T_a = 50^{\circ}C$
Q160 MOS FET	$T_{ch} (max) = 175^{\circ}C$ $P_{ch} = 28.6 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 76.1^{\circ}C$ D.F. = 43.5 %	$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 16.1^{\circ}C$		$T_c = 66.1^{\circ}C$
Q162 MOS FET	$T_{ch} (max) = 175^{\circ}C$ $P_{ch} = 28.6 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 71.9^{\circ}C$ D.F. = 41.1 %	$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 11.9^{\circ}C$		$T_c = 61.9^{\circ}C$
Q164 MOS FET	$T_{ch} (max) = 175^{\circ}C$ $P_{ch} = 28.6 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 74.6^{\circ}C$ D.F. = 42.6 %	$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 14.6^{\circ}C$		$T_c = 64.6^{\circ}C$
Q166 MOS FET	$T_{ch} (max) = 175^{\circ}C$ $P_{ch} = 28.6 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 71.4^{\circ}C$ D.F. = 40.8 %	$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 11.4^{\circ}C$		$T_c = 61.4^{\circ}C$
Q401 MOS FET	$T_{ch} (max) = 150^{\circ}C$ $P_{ch} = 2.0 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 68.7^{\circ}C$ D.F. = 45.8 %	$\theta_{ch-c} = 1.47^{\circ}C/W$ $\Delta T_c = 15.8^{\circ}C$		$T_c = 65.8^{\circ}C$
Q501 MOS FET	$T_{ch} (max) = 150^{\circ}C$ $P_{ch} = 2.0 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 65.3^{\circ}C$ D.F. = 43.6 %	$\theta_{ch-c} = 1.47^{\circ}C/W$ $\Delta T_c = 12.4^{\circ}C$		$T_c = 62.4^{\circ}C$
D1040 DIODE	$T_j (max) = 150^{\circ}C$ $P_d = 260.0 mW$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 72.2^{\circ}C$ D.F. = 48.1 %	$\theta_{j-c} = 23.0^{\circ}C/W$ $\Delta T_c = 16.2^{\circ}C$		$T_c = 66.2^{\circ}C$
D1530 DIODE	$T_j (max) = 150^{\circ}C$ $P_d = 260.0 mW$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 72.5^{\circ}C$ D.F. = 48.3 %	$\theta_{j-c} = 23.0^{\circ}C/W$ $\Delta T_c = 16.5^{\circ}C$		$T_c = 66.5^{\circ}C$

部品番号 Location No.	$V_{in} = 320VDC$	$V_o = 240VDC$	Load = 100%	$T_a = 50^{\circ}C$
A101 IC	$T_j(\max) = 125^{\circ}C$ $P_d = 150.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 70.4^{\circ}C$ D.F. = 56.3 %		$\theta_{j-c} = 3.0^{\circ}C/W$ $\Delta T_c = 19.9^{\circ}C$	$T_c = 69.9^{\circ}C$
A151 IC	$T_j(\max) = 125^{\circ}C$ $P_d = 150.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 61.0^{\circ}C$ D.F. = 48.8 %		$\theta_{j-c} = 3.0^{\circ}C/W$ $\Delta T_c = 10.5^{\circ}C$	$T_c = 60.5^{\circ}C$
A1021 CHIP IC	$T_j(\max) = 150^{\circ}C$ $P_d = 20.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 72.7^{\circ}C$ D.F. = 48.5 %		$\theta_{j-c} = 110.0^{\circ}C/W$ $\Delta T_c = 20.5^{\circ}C$	$T_c = 70.5^{\circ}C$
A1022 CHIP IC	$T_j(\max) = 150^{\circ}C$ $P_d = 80.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 78.6^{\circ}C$ D.F. = 52.4 %		$\theta_{j-c} = 105.0^{\circ}C/W$ $\Delta T_c = 20.2^{\circ}C$	$T_c = 70.2^{\circ}C$
A1518 CHIP IC	$T_j(\max) = 150^{\circ}C$ $P_d = 20.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 71.8^{\circ}C$ D.F. = 47.9 %		$\theta_{j-c} = 110.0^{\circ}C/W$ $\Delta T_c = 19.6^{\circ}C$	$T_c = 69.6^{\circ}C$
A1519 CHIP IC	$T_j(\max) = 150^{\circ}C$ $P_d = 80.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 80.1^{\circ}C$ D.F. = 53.4 %		$\theta_{j-c} = 105.0^{\circ}C/W$ $\Delta T_c = 21.7^{\circ}C$	$T_c = 71.7^{\circ}C$
A8001 CHIP IC	$T_j(\max) = 150^{\circ}C$ $P_d = 66.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 74.2^{\circ}C$ D.F. = 49.5 %		$\theta_{j-c} = 9.4^{\circ}C/W$ $\Delta T_c = 23.6^{\circ}C$	$T_c = 73.6^{\circ}C$

(2.2) 回生 Regeneration mode

部品番号 Location No.	$V_{in} = 240VDC$	$V_o = 320VDC$	Load = 100%	$T_a = 50^{\circ}C$
Q41 MOS FET	Tch (max) = 150 °C Pch = 9.4 W Tch = Tc + ((θ_{ch-c}) × Pch) = 71.3 °C D.F. = 47.6 %		$\theta_{ch-c} = 0.28^{\circ}C/W$ $\Delta T_c = 18.7^{\circ}C$	Tc= 68.7 °C
Q105 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 68.9 °C D.F. = 39.3 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 08.9^{\circ}C$	Tc= 58.9 °C
Q107 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 70.9 °C D.F. = 40.5 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 10.9^{\circ}C$	Tc= 60.9 °C
Q109 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 69.9 °C D.F. = 39.9 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 09.9^{\circ}C$	Tc= 59.9 °C
Q112 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 72.9 °C D.F. = 41.6 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 12.9^{\circ}C$	Tc= 62.9 °C
Q113 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 72.0 °C D.F. = 41.1 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 12.0^{\circ}C$	Tc= 62.0 °C
Q115 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 74.4 °C D.F. = 42.5 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 14.4^{\circ}C$	Tc= 64.4 °C
Q152 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 72.1 °C D.F. = 41.2 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 12.1^{\circ}C$	Tc= 62.1 °C
Q154 MOS FET	Tch (max) = 175 °C Pch = 28.6 W Tch = Tc + ((θ_{ch-c}) × Pch) = 71.8 °C D.F. = 41.0 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 11.8^{\circ}C$	Tc= 61.8 °C

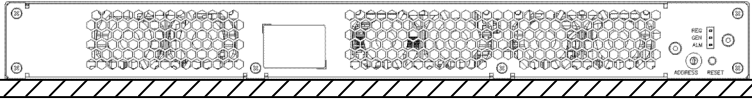
部品番号 Location No.	$V_{in} = 240VDC$	$V_o = 320VDC$	Load = 100%	$T_a = 50^{\circ}C$
Q160 MOS FET	$T_{ch} (max) = 175^{\circ}C$ $P_{ch} = 28.6 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 78.6^{\circ}C$ D.F. = 44.9 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 18.6^{\circ}C$	$T_c = 68.6^{\circ}C$
Q162 MOS FET	$T_{ch} (max) = 175^{\circ}C$ $P_{ch} = 28.6 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 72.2^{\circ}C$ D.F. = 41.2 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 12.2^{\circ}C$	$T_c = 62.2^{\circ}C$
Q164 MOS FET	$T_{ch} (max) = 175^{\circ}C$ $P_{ch} = 28.6 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 77.7^{\circ}C$ D.F. = 44.4 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 17.7^{\circ}C$	$T_c = 67.7^{\circ}C$
Q166 MOS FET	$T_{ch} (max) = 175^{\circ}C$ $P_{ch} = 28.6 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 72.3^{\circ}C$ D.F. = 41.3 %		$\theta_{ch-c} = 0.35^{\circ}C/W$ $\Delta T_c = 12.3^{\circ}C$	$T_c = 62.3^{\circ}C$
Q401 MOS FET	$T_{ch} (max) = 150^{\circ}C$ $P_{ch} = 1.8 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 67.4^{\circ}C$ D.F. = 44.9 %		$\theta_{ch-c} = 1.47^{\circ}C/W$ $\Delta T_c = 14.7^{\circ}C$	$T_c = 64.7^{\circ}C$
Q501 MOS FET	$T_{ch} (max) = 150^{\circ}C$ $P_{ch} = 1.7 W$ $T_{ch} = T_c + ((\theta_{ch-c}) \times P_{ch}) = 64.3^{\circ}C$ D.F. = 42.9 %		$\theta_{ch-c} = 1.47^{\circ}C/W$ $\Delta T_c = 11.8^{\circ}C$	$T_c = 61.8^{\circ}C$
D1040 DIODE	$T_j (max) = 150^{\circ}C$ $P_d = 260.0 mW$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 70.0^{\circ}C$ D.F. = 46.7 %		$\theta_{j-c} = 23.0^{\circ}C/W$ $\Delta T_c = 14.0^{\circ}C$	$T_c = 64.0^{\circ}C$
D1530 DIODE	$T_j (max) = 150^{\circ}C$ $P_d = 260.0 mW$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 74.3^{\circ}C$ D.F. = 49.5 %		$\theta_{j-c} = 23.0^{\circ}C/W$ $\Delta T_c = 18.3^{\circ}C$	$T_c = 68.3^{\circ}C$

部品番号 Location No.	$V_{in} = 240VDC$	$V_o = 320VDC$	Load = 100%	$T_a = 50^{\circ}C$
A101 IC	$T_j(\max) = 125^{\circ}C$ $P_d = 150.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 70.0^{\circ}C$ D.F. = 56.0 %	$\theta_{j-c} = 3.0^{\circ}C/W$ $\Delta T_c = 19.5^{\circ}C$		$T_c = 69.5^{\circ}C$
A151 IC	$T_j(\max) = 125^{\circ}C$ $P_d = 150.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 61.1^{\circ}C$ D.F. = 48.8 %	$\theta_{j-c} = 3.0^{\circ}C/W$ $\Delta T_c = 10.6^{\circ}C$		$T_c = 60.6^{\circ}C$
A1021 CHIP IC	$T_j(\max) = 150^{\circ}C$ $P_d = 20.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 72.0^{\circ}C$ D.F. = 48.0 %	$\theta_{j-c} = 110.0^{\circ}C/W$ $\Delta T_c = 19.8^{\circ}C$		$T_c = 69.8^{\circ}C$
A1022 CHIP IC	$T_j(\max) = 150^{\circ}C$ $P_d = 80.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 77.8^{\circ}C$ D.F. = 51.9 %	$\theta_{j-c} = 105.0^{\circ}C/W$ $\Delta T_c = 19.4^{\circ}C$		$T_c = 69.4^{\circ}C$
A1518 CHIP IC	$T_j(\max) = 150^{\circ}C$ $P_d = 20.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 70.7^{\circ}C$ D.F. = 47.1 %	$\theta_{j-c} = 110.0^{\circ}C/W$ $\Delta T_c = 18.5^{\circ}C$		$T_c = 68.5^{\circ}C$
A1519 CHIP IC	$T_j(\max) = 150^{\circ}C$ $P_d = 80.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 80.0^{\circ}C$ D.F. = 53.3 %	$\theta_{j-c} = 105.0^{\circ}C/W$ $\Delta T_c = 21.6^{\circ}C$		$T_c = 71.6^{\circ}C$
A8001 CHIP IC	$T_j(\max) = 150^{\circ}C$ $P_d = 66.0\text{ mW}$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 73.1^{\circ}C$ D.F. = 48.7 %	$\theta_{j-c} = 9.4^{\circ}C/W$ $\Delta T_c = 22.5^{\circ}C$		$T_c = 72.5^{\circ}C$

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

MODEL : EZA11K-320240

(1) 測定条件 Measuring conditions

取付方法 Mounting Method	標準取付 Standard mounting	
		
電力変換方向 Power Conversion Direction	力行 Generation Mode	回生 Regeneration Mode
入力電圧 V_{in} Input Voltage	320VDC	240VDC
出力電圧 V_o Output Voltage	240VDC	320VDC
出力電流 I_o Output Current	45.8A(100%)	34.4A(100%)

(2) 測定結果 Measuring results

(2-1) 力行 Generation mode

部品番号 Location No.	部品名 Part name	ΔT temperature rise ($^{\circ}\text{C}$)
		標準取付 Standard mounting
Q41	MOS FET	18.0
Q105	MOS FET	9.5
Q107	MOS FET	11.0
Q109	MOS FET	11.2
Q111	MOS FET	13.7
Q113	MOS FET	12.4
Q115	MOS FET	14.4
Q152	MOS FET	9.9
Q154	MOS FET	11.0
Q160	MOS FET	16.1
Q162	MOS FET	11.9
Q164	MOS FET	14.6
Q166	MOS FET	11.4
Q401	MOS FET	15.8
Q501	MOS FET	12.4
D1040	DIODE	16.2
D1530	DIODE	16.5
A101	IC	19.9
A151	IC	10.5

部品番号 Location No.	部品名 Part name	ΔT temperature rise (°C)
		標準取付 Standard mounting
A1021	CHIP IC	20.5
A1022	CHIP IC	20.2
A1518	CHIP IC	19.6
A1519	CHIP IC	21.7
A8001	CHIP IC	23.6
L1	CHOKE COIL	11.2
L41	CHOKE COIL	22.5
L101	CHOKE COIL Core	29.5
	CHOKE COIL Winding	17.1
L102	CHOKE COIL Core	34.9
	CHOKE COIL Winding	29.8
L151	CHOKE COIL Core	24.9
	CHOKE COIL Winding	31.0
L152	CHOKE COIL Core	30.3
	CHOKE COIL Winding	31.3
T1	TRANSFORMER Core	15.5
	TRANSFORMER Pri. winding	7.0
	TRANSFORMER Sec. winding	17.4
T2	TRANSFORMER Core	35.2
	TRANSFORMER Pri. winding	22.5
	TRANSFORMER Sec. winding	28.9
C101	E. CAP.	6.2
C151	E. CAP.	8.8
TH102	THERMISTOR	8.2
TH152	THERMISTOR	9.3
PC6001	COUPLER	16.7
PC8003	COUPLER	15.3
PC8004	COUPLER	8.4
T401	TRANSFORMER	20.0

(2-2) 回生 Regeneration mode

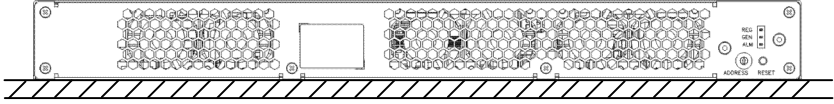
部品番号 Location No.	部品名 Part name	ΔT temperature rise (°C)
		標準取付 Standard mounting
Q41	MOS FET	18.7
Q105	MOS FET	8.9
Q107	MOS FET	10.9
Q109	MOS FET	9.9
Q111	MOS FET	12.9
Q113	MOS FET	12.0
Q115	MOS FET	14.4
Q152	MOS FET	12.1
Q154	MOS FET	11.8
Q160	MOS FET	18.6
Q162	MOS FET	12.2
Q164	MOS FET	17.7
Q166	MOS FET	12.3
Q401	MOS FET	14.7
Q501	MOS FET	11.8
D1040	DIODE	14.0
D1530	DIODE	18.3
A101	IC	19.5
A151	IC	10.6

部品番号 Location No.	部品名 Part name	ΔT temperature rise (°C)
		標準取付 Standard mounting
A1021	CHIP IC	19.8
A1022	CHIP IC	19.4
A1518	CHIP IC	18.5
A1519	CHIP IC	21.6
A8001	CHIP IC	22.5
L1	CHOKE COIL	10.1
L41	CHOKE COIL	23.9
L101	CHOKE COIL Core	29.2
	CHOKE COIL Winding	16.4
L102	CHOKE COIL Core	34.6
	CHOKE COIL Winding	29.3
L151	CHOKE COIL Core	24.0
	CHOKE COIL Winding	30.0
L152	CHOKE COIL Core	29.6
	CHOKE COIL Winding	31.1
T1	TRANSFORMER Core	13.7
	TRANSFORMER Pri. winding	6.3
	TRANSFORMER Sec. winding	16.3
T2	TRANSFORMER Core	32.2
	TRANSFORMER Pri. winding	21.8
	TRANSFORMER Sec. winding	27.9
C101	E. CAP.	6.0
C151	E. CAP.	9.2
TH102	THERMISTOR	7.4
TH152	THERMISTOR	10.8
PC6001	COUPLER	15.6
PC8003	COUPLER	14.2
PC8004	COUPLER	7.6
T401	TRANSFORMER	19.0

4. 電解コンデンサ推定寿命計算 Electrolytic Capacitor Lifetime

MODEL : EZA11K-320240

(1) 測定条件 Measuring conditions

取付方法 Mounting method	標準取付 Standard mounting 	
電力変換方向 Power conversion direction	力行 Generation mode	回生 Regeneration mode
入力電圧 V_{in} Input voltage	240VDC - 400VDC	150VDC - 300VDC
出力電圧 V_o Output voltage	150VDC - 300VDC	240VDC - 400VDC
出力電流 I_o Output current	100%(最大電流はグリッド電流では40A、バッテリー電流では50Aに制限されています。) The maximum output current is limited to 40A for the grid current and 50A for the battery current.	

$T_a = 50\text{ }^\circ\text{C}$

Load (%)	Lifetime (years)
100	10.0

図に示す電圧範囲内で、電解コンデンサの推定寿命が10年であることを確認しています。

Electrolytic capacitors lifetime is 10 years within the voltage range shown in the drawing.

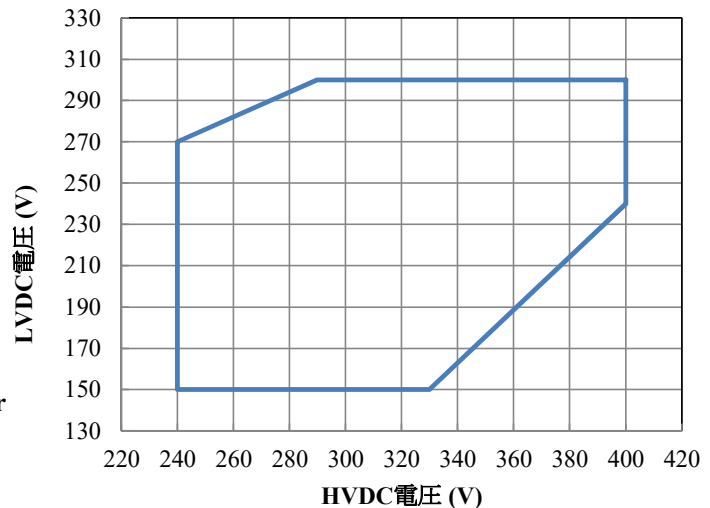
<算出式>

$$L = L_0 \times 2^{\frac{105 - T_c}{10}} \text{ 時間 (hours)}$$

L : 電解コンデンサ推定寿命
: Electrolytic capacitor lifetime

L_0 : 電解コンデンサ保証寿命
: Guarantee life for electrolytic capacitor

T_c : 電解コンデンサケース温度
: Case temperature of electrolytic capacitor



5. アブノーマル試験 Abnormal Test

MODEL : EZA11K-320240

(1) 試験条件 Test conditions

Input : 320VDC Output : 240VDC, 45.8A (100%) Ta : 25°C

(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	b	c	d	e	f	g	h	I	j	k		l
					発火 Fire	発煙 Smoke	破裂 Burst	異臭 Smell	赤熱 Red hot	破損 Damaged	ヒューズ断 Fuse blown	OVP	OCP	出力断 No output	変化なし No change		その他 Others
1	Q1	G-S	○							○						○	Da: R61 Efficiency down
		D-S	○												○		
		G-D	○								○					○	Da: R61 Efficiency down
		G		○												○	Efficiency down
		D		○												○	Efficiency down
		S		○												○	Efficiency down
2	Q41	G-S	○							○						○	Da: R82 Efficiency down
		D-S	○												○		
		G-D	○								○					○	Da: R82 Efficiency down
		G		○												○	Efficiency down
		D		○												○	Efficiency down
		S		○												○	Efficiency down
3	Q101	G-S	○							○				○			Da: Q102, Q103, Q104
		D-S	○							○				○			Da: Q2, Q102, Q103, Q104, Q1006, Q1007, A1011, R1067
		G-D	○							○				○			Da: Q103, Q104, A1011, R1052, R1067
		G		○							○						Da: Q103, Q104
		D		○							○						Da: Q102, Q103, Q104
		S		○							○						Da: Q102, Q103, Q104
4	Q103	G-S	○							○				○			Da: Q101, Q102, Q104
		D-S	○							○				○			Da: Q101, Q102
		G-D	○							○				○			Da: Q101, Q102
		G		○							○						Da: Q101, Q102
		D		○							○						Da: Q101, Q102, Q104
		S		○							○						Da: Q101, Q102, Q104

(Da : Damaged)

No.	Test position		Test mode		Test result											記事 Note	
	部品No.	試験端子	ショート	オープン	a	b	c	d	e	f	g	h	I	j	k		l
					発火	発煙	破裂	異臭	赤熱	破損	ヒューズ断	OV P	OC P	出力断	変化なし		その他
Location No.	Test point	Short	Open	Fire	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown				No output	No change	Others	
5	Q156	G-S	○							○				○			Da: Q155, Q157, Q158
		D-S	○							○				○			Da: Q157, Q158
		G-D	○							○				○			Da: Q157, Q158
		G		○						○				○			Da: Q157, Q158
		D		○						○				○			Da: Q155, Q157, Q158
		S		○						○				○			Da: Q155, Q157, Q158
6	Q158	G-S	○							○				○			Da: Q155, Q156, Q157
		D-S	○							○				○			Da: Q155, Q156
		G-D	○							○				○			Da: Q155, Q156
		G		○						○				○			Da: Q155, Q156
		D		○						○				○			Da: Q155, Q156, Q157
		S		○						○				○			Da: Q155, Q156, Q157
7	Q1004	G-S	○												○		
		D-S	○							○				○			Da: Q102, Q103, Q104
		G-D	○							○				○			Da: Q102, Q103, Q104
		G		○						○				○			Da: Q102, Q103, Q104
		D		○											○		
		S		○											○		
8	Q401	G-S	○											○			
		D-S	○								○			○			Fuse: F401
		G-D	○							○	○			○			Fuse: F401, Da: Q401
		G		○										○			
		D		○										○			
		S		○										○			
9	Q501	G-S	○											○			
		D-S	○								○			○			Fuse: F501
		G-D	○							○	○			○			Fuse: F501, Da: Q501
		G		○										○			
		D		○										○			
		S		○										○			
10	Q651	G-S	○											○			
		D-S	○												○		
		G-D	○											○			
		G		○										○			
		D		○										○			
		S		○										○			
11	Z61	A-K	○											○			
		A-K		○											○		

(Da : Damaged)

No.	Test position		Test mode		Test result											記事 Note		
	部品No.	試験端子	ショート	オープン	a	b	c	d	e	f	g	h	I	j	k		l	
	Location No.	Test point	Short	Open	発火 Fire	発煙 Smoke	破裂 Burst	異臭 Smell	赤熱 Red hot	破損 Damaged	ヒューズ断 Fuse blown	OVP	OCP	出力断 No output	変化なし No change	その他 Others		
12	L101	1-2	○													○	Efficiency down	
		1		○						○				○				Da: Q2,Q105-Q116, Q151-Q154,Q159-Q166
		2		○							○			○				Da: Q2,Q105-Q116, Q151-Q154,Q159-Q166
13	L151	1-2	○													○	Efficiency down	
		1		○						○				○			Da: Q2,Q105-Q116, Q151-Q154,Q159-Q166	
		2		○							○			○				Da: Q2,Q105-Q116, Q151-Q154,Q159-Q166
14	T1	1-7	○										○	○				
		13-19	○										○	○				
		1		○							○				○			Da: Q2,Q105-Q116, Q151-Q154,Q159-Q166
		7		○							○				○			Da: Q2,Q105-Q116, Q151-Q154,Q159-Q166
		13		○							○				○			Da: Q2,Q105-Q116, Q151-Q154,Q159-Q166
		19		○							○				○			Da: Q2,Q105-Q116, Q151-Q154,Q159-Q166
15	C1		○								○							Fuse: F1
				○												○		
16	C4		○							○	○				○			Fuse: F1, Da: Q1,Q2,Q3
				○												○		

6. 振動試験 Vibration Test

MODEL : EZA11K-320240

(1) 振動試験種類 Vibration test class

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

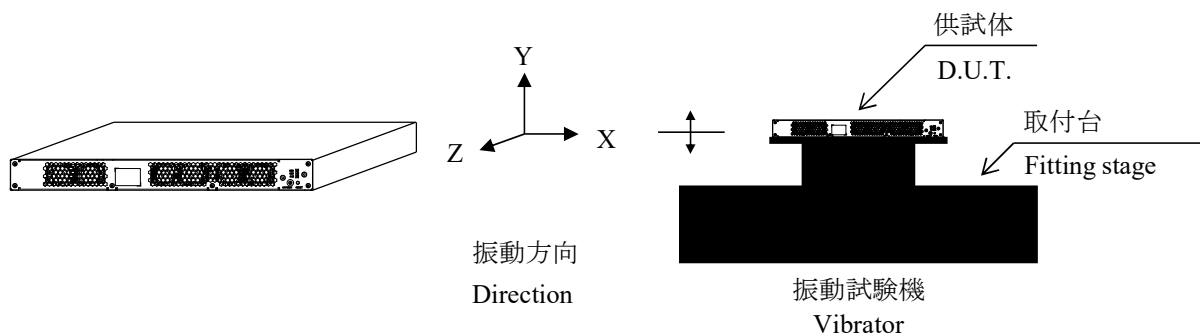
(2) 使用機器 Equipment used

・衝撃試験機 : F-16000BAH/LA16AW
Impact test machine

(3) 試験条件 Test conditions

- | | |
|---|--|
| ・ 周波数範囲 : 10 - 55Hz
Sweep frequency | ・ 振動方向 : X, Y, Z
Direction |
| ・ 掃引時間 : 1.0分間
Sweep time 1.0min | ・ 試験時間 : 各方向共 1時間
Sweep count 1 hour each |
| ・ 加速度 : 一定 19.6m/s ² (2G)
Acceleration Constant | |

(4) 試験方法 Test method



(5) 判定条件 Acceptable conditions

1. 破損しない事
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. 衝撃試験 Shock Test

MODEL : EZA11K-320240

(1) 衝撃試験種類 Shock test class

衝撃試験 Shock test

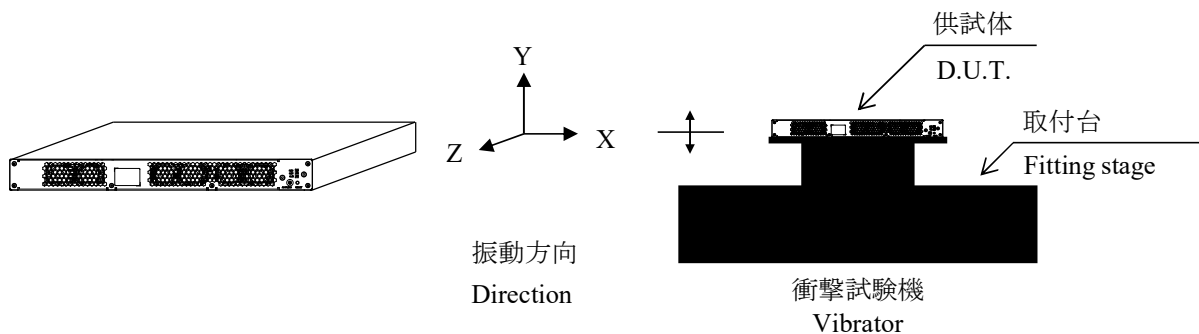
(2) 使用機器 Equipment used

・衝撃試験機 : F-16000BAH/LA16AW
Impact test machine

(3) 試験条件 Test conditions

- | | |
|--|---|
| ・加速度 : 196.1m/s ² (20G)
Acceleration | ・振動方向 : X, Y, Z
Direction |
| ・試験時間 : 11msec
Test time | ・回数 : +、-方向に各3回
Number of times 3 times each for +,- direction |

(4) 試験方法 Test method



(5) 判定条件 Acceptable conditions

1. 破損しない事
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

8. ノイズシミュレート試験 Noise Simulate Test

MODEL : EZA11K-320240

(1) 使用機器 Equipment used

- シミュレータ : INS-4320(A) (Noiseken)
Simulator
- カップリングアダプタ : 15-00001A (Noiseken)
Coupling adapter

(2) 試験条件 Test conditions

- | | |
|--|---|
| 電力変換方向 : 力行(Generation mode)
Power conversion direction | ノイズ電圧 : 0 - 2kV
Noise level |
| 入力電圧 : 320VDC
Input voltage | 位相 : 0 - 360 deg
Phase |
| 出力電圧 : 240VDC
Output voltage | 極性 : +、-
Polarity |
| 出力電流 : 0A、25A (6.0kW)
Output current | 印加モード : コモン、ノーマル
Mode Common, Normal |
| 周囲温度 : 25°C
Ambient temperature | トリガ選択 : Line
Trigger select |
| パルス幅 : 50 - 1000ns
Pulse width | |

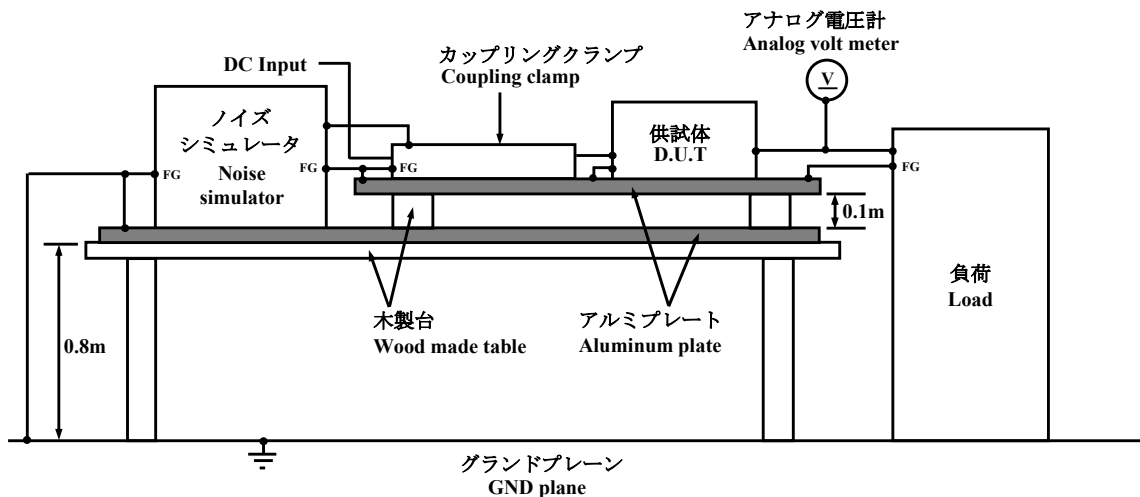
(3) 試験方法及び印加箇所 Test method and device test point

入力端子のコモンモード (+V~ \perp) 及びノーマルモード (+V~-V) に印加

Apply to Common mode (+V~ \perp) and Normal mode (+V~-V) of input terminal.

信号端子のコモンモード (+V~ \perp) に印加

Apply to Common mode (+V~ \perp) of signal terminal.



(4) 判定条件 Acceptable conditions

- 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.
- 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.
- 発煙・発火のない事
Smoke and fire are not allowed.

(5) 試験結果 Test results

合格 OK

9. 熱衝撃試験 Thermal Shock Test

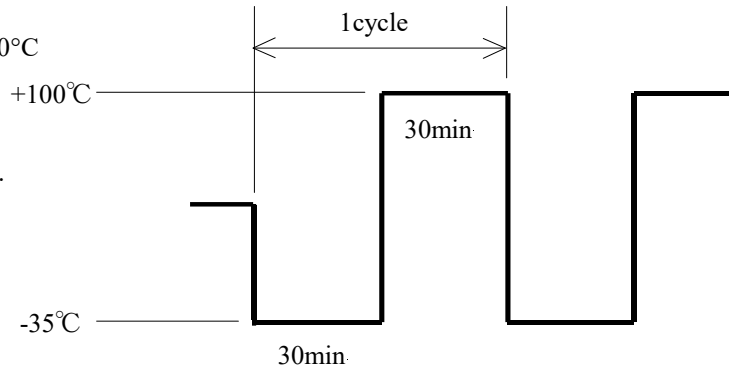
MODEL : EZA11K-320240

(1) 使用機器 Equipment used

- 冷熱衝撃試験機 : TSA-101L-A(ESPEC)
Thermal shock chamber

(2) 試験条件 Test conditions

- 電源周囲温度 : $-35^{\circ}\text{C} \leftrightarrow 100^{\circ}\text{C}$
Ambient temperature
- 試験時間 : 図参照
Test time Refer to Dwg.
- 試験サイクル : 800 サイクル
Test cycle 800 Cycles
- 非動作
Not operating



(3) 試験方法 Test method

初期測定の後、供試品を試験槽に入れ、上記サイクルで試験を行う。800サイクル後に、供試品を常温常湿下に1時間放置し、出力に異常がない事を確認する。

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

(4) 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.

(5) 試験結果 Test results

合格 OK

試験条件が部品保存温度を満足しないため、
熱衝撃試験結果にファンとYコンデンサは含まれておりません。
Fan and Y capacitor are not included in the thermal shock test result.
Because the test condition is out of the component storage temperature range.

10. 通電加湿試験 Humidity Test

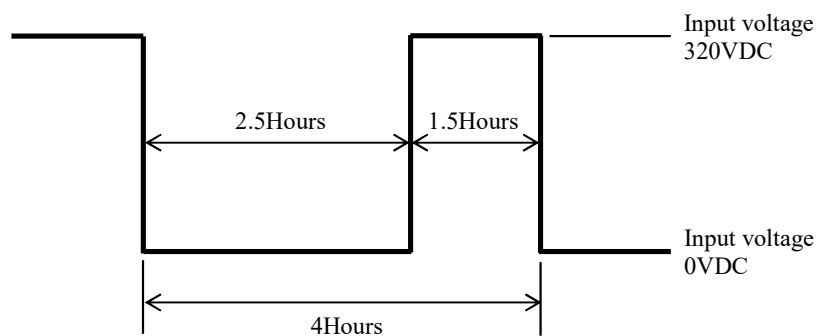
MODEL : EZA11K-320240

(1) 使用機器 Equipment used

- 恒温槽 : PL-4KP (ESPEC)
Chamber

(2) 試験条件 Test conditions

- | | |
|---|--|
| • 電力変換方向 : 力行 (Generation mode)
Power conversion direction | • 電源周囲温度 : +60°C
Ambient temperature |
| • 入力電圧 : 0VDC ⇔ 320VDC
Input voltage | • 湿度 : 90%
Humidity |
| • 出力電圧 : 240VDC
Output voltage | • 出力電流 : 0A
Test time |
| • 試験時間 : 400時間
Output voltage 400Hours | • 試験サイクル : 図参照
Test cycle Refer to Dwg. |



(3) 試験方法 Test method

初期測定後、恒温恒湿槽に試供電源を入れ、槽内温度を25°Cから60°Cまで上昇させる。
上記の条件で400時間動作させ、その後、常温常湿で1時間放置し出力に異常が無い事を確認する。
Check to make sure that there is no abnormal output before test.

Then put the D.U.T in testing chamber, and the chamber temperature is gradually increased from 25°C to 60°C. Operate the D.U.T for 400 hours according to above condition and leave D.U.T for 1 hour at the room temperature, then check to make sure there is no abnormal output.

(4) 試験結果 Test results

合格 OK