VS30C

RELIABILITY DATA

DWG No. : CA711-57-01B		
APPD	CHK	DWG
20-NOV.07	20/NOV/07	20-Nov-07

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 OF MTBF

MODEL : VS30C-5

(1) Calculating method

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

<Formula> :

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

λ_{equip}	: Total Equipment Failure Rate (Failure/10^6 Hours)
λ_G	: Generic Failure Rate for The ith Generic Part (Failure/10^6 Hours)
N_i	: Quantity of ith Generic Part
n	: Number of Different Generic Part Categories
π_Q	: Generic Quality Factor for The ith Generic Part (π_Q =1)

(2) MTBF Values

GF : (Ground , Fixed)

MTBF ≒620,624 (Hours)

2. COMPONENT DERATING

MODEL: VS30C-5

(1) Calculating Method

(a) Measuring conditions

Input	: 100VAC ,	Ambient temperature	: 50°C
Output	: 5V 6A(100%) ,	Mounting method	: Standard Mounting

(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_l	: Lead Temperature at Start Point of Derating ; 25°C in General
$P_{c(max)}$ ($P_{ch(max)}$)	: Maximum Collector(Channel) Dissipation
$T_{j(max)}$ ($T_{ch(max)}$)	: Maximum Junction(Channel) Temperature
θ_{j-c} (θ_{ch-c})	: Thermal Impedance between Junction(Channel) and Case
θ_{j-a}	: Thermal Impedance between Junction and Air
θ_{j-l}	: Thermal Impedance between Junction and lead

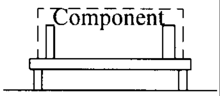
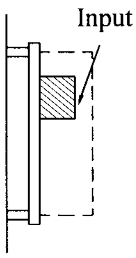
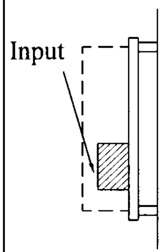
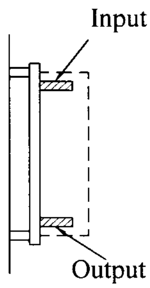
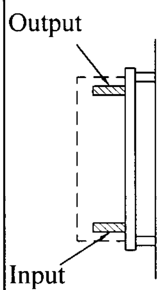
(2) Component Derating List

Location No.	Vin = 100VAC Load = 100% Ta = 50°C		
A1 HA17431PA HITACHI	Tjmax = 150 °C, Pd = 0.017 W, Tj = Ta + ((θj - a) x Pd) = 72.5 °C D.F. = 48.3 %	θ j-a = 156.3 °C /W, Δ Ta = 19.8 °C,	Pj(max) = 0.8 W Ta = 69.8 °C
D1 D2SB60 SHINDENGEN	Tjmax = 150 °C, Pd = 0.7 W, Tj = Tl + ((θj - l) x Pd) = 108.2 °C D.F. = 72.1 %	θ j-l = 10 °C /W, Δ Tl = 51.2 °C,	Pj(max) = - W Tl = 101.2 °C
D2 SF30SC4 SHINDENGEN	Tjmax = 150 °C, Pd = 3.3 W, Tj = Tc + ((θj - c) x Pd) = 111.6 °C D.F. = 74.4 %	θ j-c = 2 °C /W, Δ Tc = 55 °C,	Pj(max) = - W Tc = 105 °C
D3 1SS178 TOSHIBA	Tjmax = 175 °C, Pd = 0.01 W, Tj = Ta + ((θj - a) x Pd) = 95.7 °C D.F. = 54.7 %	θ j-a = 500 °C /W, ΔTa = 40.7 °C,	Pj(max) = 0.3 W Ta = 90.7 °C
D4 1SS178 TOSHIBA	Tjmax = 175 °C, Pd = 0.001 W, Tj = Ta + ((θj - a) x Pd) = 87.6 °C D.F. = 50.1 %	θ j-a = 500 °C /W, ΔTa = 37.1 °C,	Pj(max) = 0.3 W Ta = 87.1 °C
Q1 2SK2185 SHINDENGEN	Tchmax = 150 °C, Pd = 1.71 W, Tch = Tc + ((θch - c) x Pd) = 102.2 °C D.F. = 68.1 %	θ ch-c = 4.17 °C /W, ΔTc = 45.1 °C,	Pch(max) = - W Tc = 95.1 °C
Q2 2SD467C HITACHI	Tjmax = 150 °C, Pd = 0.012 W, Tj = Ta + ((θj - a) x Pd) = 89.2 °C D.F. = 59.5 %	θ j-a = 250 °C /W, ΔTa = 36.2 °C,	Pc(max) = 0.5 W Ta = 86.2 °C
PC1 PS2561-1-V-L (LED) NEC	Tjmax = 125 °C, If = 2.7 mA, If (max) = 51.5mA (at Ta = 76.4 °C) D.F. = 5.2 %	ΔPj /°C = -1.5 mW /°C, ΔTa = 26.4 °C,	Pj(max) = 0.15 W Ta = 76.4 °C
PC1 PS2561-1-V-L (Transistor) NEC	Tjmax = 125 °C, Pd = 0.009 W, Tj = Ta + ((θj - a) x Pd) = 82.4 °C D.F. = 65.9 %	θ j-a = 667 °C /W, ΔTa = 26.4 °C,	Pc(max) = 0.15 W Ta = 76.4 °C
ZD1 HZS24NB3 HITACHI	Tjmax = 200 °C, Pd = 0.017 W, Tj = Ta + ((θj - a) x Pd) = 108.6 °C D.F. = 54.3 %	θ j-a = 437.5 °C /W, ΔTa = 51.2 °C,	Pj(max) = 0.4 W Ta = 101.2 °C
ZD2 HZS15NB2 HITACHI	Tjmax = 200 °C, Pd = 0 W, Tj = Ta + ((θj - a) x Pd) = 86.2 °C D.F. = 43.1 %	θ j-a = 437.5 °C /W, ΔTa = 36.2 °C,	Pj(max) = 0.4 W Ta = 86.2 °C
ZD3 HZS11B2L HITACHI	Tjmax = 200 °C, Pd = 0 W, Tj = Ta + ((θj - a) x Pd) = 92 °C D.F. = 46 %	θ j-a = 437.5 °C /W, ΔTa = 42 °C,	Pj(max) = 0.4 W Ta = 92 °C
ZD4 HZ6.2CP HITACHI	Tjmax = 175 °C, Pd = 0 W, Tj = Ta + ((θj - a) x Pd) = 97.4 °C D.F. = 55.7 %	θ j-a = 187.5 °C /W, ΔTa = 47.4 °C,	Pj(max) = 0.8 W Ta = 97.4 °C

3. MAIN COMPONENTS TEMPERATURE RISE ΔT LIST

MODEL : VS30C-5

Measuring Conditions

	(A)	(B)	(C)	(D)	(E)
Mounting Method (Standard Mounting Method:(A))	Horizontal mounting 	Vertical mounting 	Vertical mounting 	Vertical mounting 	Vertical mounting 
Input Voltage (VAC)	100	100	100	100	100
Output Voltage (VDC)	5	5	5	5	5
Output Current (A)	6	6	6	6	5.4

*Condition Ta = 50°C , Convection cooling .

		ΔT Temperature rise (°C)				
Output Derating (%) Ta = 50°C		100%	100%	100%	100%	90%
Location No.	Parts Name	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E
Q1	MOSFET	45.1	50.0	44.4	50.8	42.0
D1	BRIDGE DIODE	51.2	47.7	51.3	53.8	42.9
D2	OUTPUT DIODE	55.0	55.9	54.4	54.1	53.8
T1	X'MER.	47.6	40.5	48.0	45.8	40.5
C3	E. CAP.	22.6	20.0	29.3	28.5	22.3
C7	E. CAP.	38.8	36.7	39.3	38.4	37.4
C12	E. CAP.	19.9	18.7	24.1	18.8	28.7
C14	E. CAP.	26.0	27.2	25.4	24.5	35.3

4. ELECTROLYTIC CAPACITOR LIFETIME VERSUS LOAD

MODEL : VS30C - 5

Mounting A
Input : 100VAC

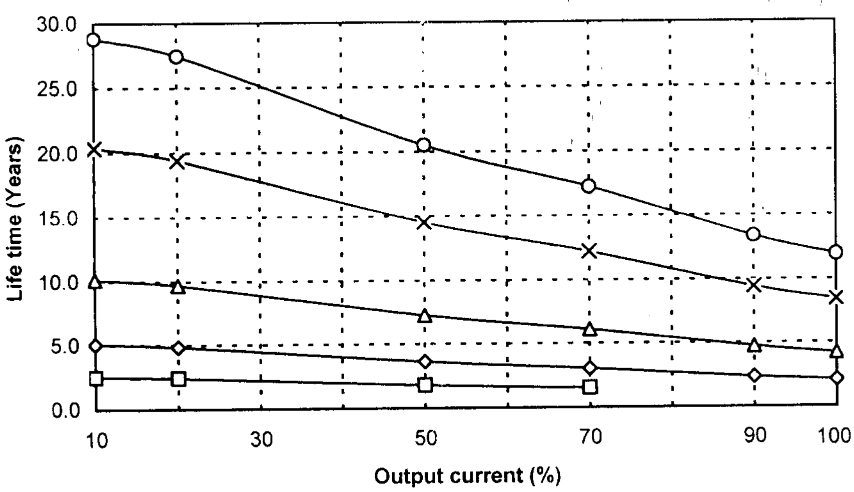
LOAD %	Life time (years) Ta (℃)				
	25.0	30.0	40.0	50.0	60.0
10	28.8	20.4	10.2	5.1	2.5
20	27.5	19.4	9.7	4.9	2.4
50	20.5	14.5	7.3	3.6	1.8
70	17.3	12.2	6.1	3.1	1.5
90	13.4	9.4	4.7	2.4	—
100	11.9	8.4	4.2	2.1	—

$$L = Lo \times 2^{(105 - Tc)/10} \quad (\text{Yrs})$$

L : Elec. Capacitor computed life (24 Hrs / day , 365 days / year)

Lo : Guarantee life for Elec. Capacitor

Tc(ΔT+Ta) : Case temperature of Elec. Capacitor



Ta=25℃ —○— Ta=30℃ —×— Ta=40℃ —△— Ta=50℃ —◇— Ta=60℃ —□—

Mounting A Mounting B Mounting C Mounting D Mounting E

4. ELECTROLYTIC CAPACITOR LIFETIME VERSUS LOAD

MODEL : VS30C - 5

Mounting B
Input : 100VAC

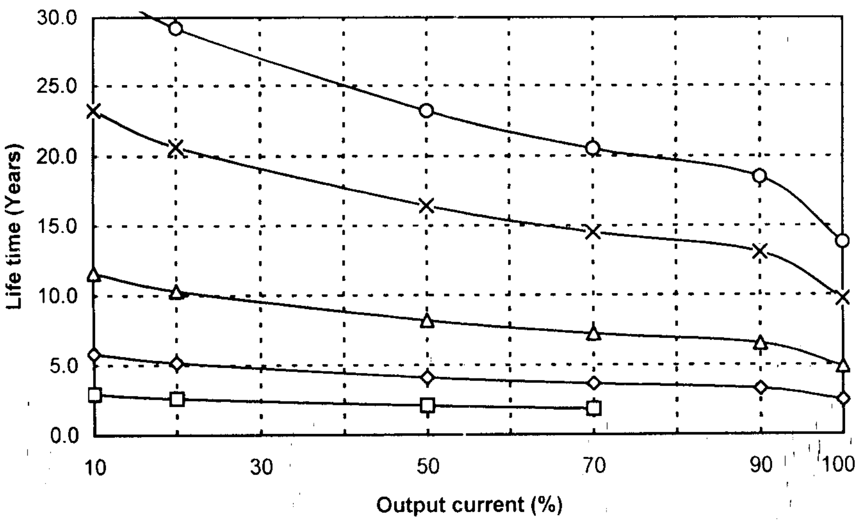
LOAD %	Life time (years) Ta (℃)				
	25.0	30.0	40.0	50.0	60.0
10	32.9	23.3	11.6	5.8	2.9
20	29.2	20.7	10.3	5.2	2.6
50	23.2	16.4	8.2	4.1	2.1
70	20.5	14.5	7.3	3.6	1.8
90	18.5	13.1	6.5	3.3	—
100	13.8	9.7	4.9	2.4	—

$$L = Lo \times 2^{(105 - Tc)/10} \quad (Yrs)$$

L : Elec. Capacitor computed life (24 Hrs / day , 365 days / year)

Lo : Guarantee life for Elec. Capacitor

Tc(ΔT+Ta) : Case temperature of Elec. Capacitor



Ta=25℃ —○— Ta=30℃ —×— Ta=40℃ —△— Ta=50℃ —◇— Ta=60℃ —□—

Mounting A Mounting B Mounting C Mounting D Mounting E

4. ELECTROLYTIC CAPACITOR LIFETIME VERSUS LOAD

MODEL : VS30C - 5

Mounting C
Input : 100VAC

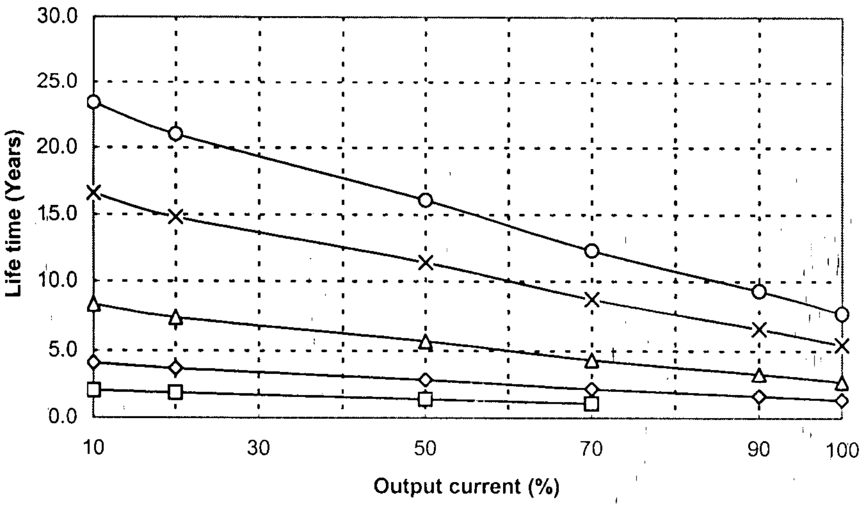
LOAD %	Life time (years) Ta (℃)				
	25.0	30.0	40.0	50.0	60.0
10	23.4	16.6	8.3	4.1	2.1
20	21.0	14.8	7.4	3.7	1.9
50	16.1	11.4	5.7	2.9	1.4
70	12.3	8.7	4.3	2.2	1.1
90	9.3	6.6	3.3	1.7	—
100	7.7	5.4	2.7	1.4	—

$$L = Lo \times 2^{(105 - Tc) / 10} \quad (\text{Yrs})$$

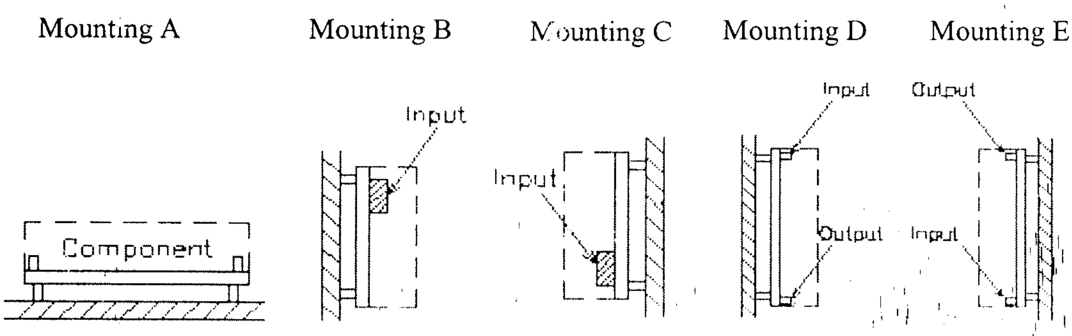
L : Elec. Capacitor computed life (24 Hrs / day , 365 days / year)

Lo : Guarantee life for Elec. Capacitor

Tc(ΔT+Ta) : Case temperature of Elec. Capacitor



Ta=25℃ —○— Ta=30℃ —×— Ta=40℃ —△— Ta=50℃ —◇— Ta=60℃ —□—



4. ELECTROLYTIC CAPACITOR LIFETIME VERSUS LOAD

MODEL : VS30C - 5

Mounting D
Input : 100VAC

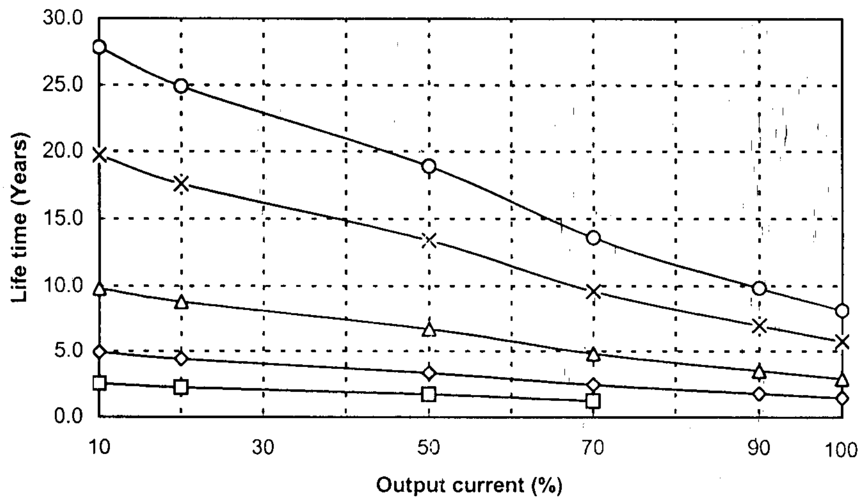
LOAD %	Life time (years) Ta (℃)				
	25.0	30.0	40.0	50.0	60.0
10	27.8	19.7	9.8	4.9	2.5
20	24.9	17.6	8.8	4.4	2.2
50	18.9	13.4	6.7	3.3	1.7
70	13.6	9.6	4.8	2.4	1.2
90	9.8	7.0	3.5	1.7	—
100	8.1	5.7	2.9	1.4	—

$$L = Lo \times 2^{(105 - Tc)/10} \quad (Yrs)$$

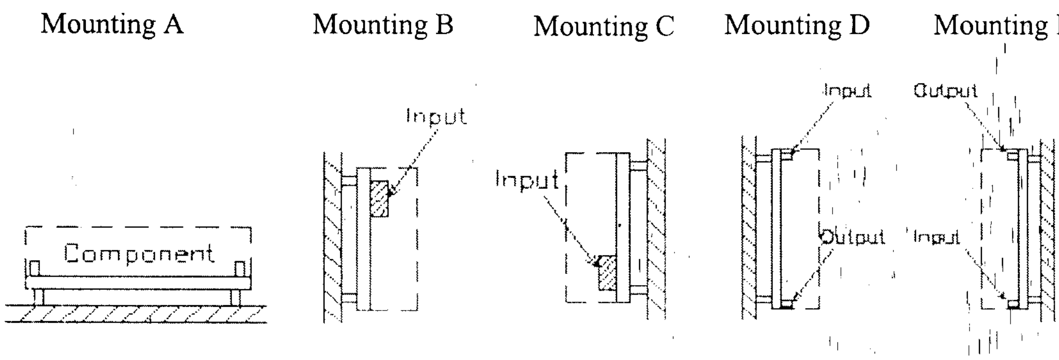
L : Elec. Capacitor computed life (24 Hrs / day , 365 days / year)

Lo : Guarantee life for Elec. Capacitor

Tc(ΔT+Ta) : Case temperature of Elec. Capacitor



Ta=25℃ —○— Ta=30℃ —×— Ta=40℃ —△— Ta=50℃ —◇— Ta=60℃ —□—



4. ELECTROLYTIC CAPACITOR LIFETIME VERSUS LOAD

MODEL : VS30C - 5

Mounting E
Input : 100VAC

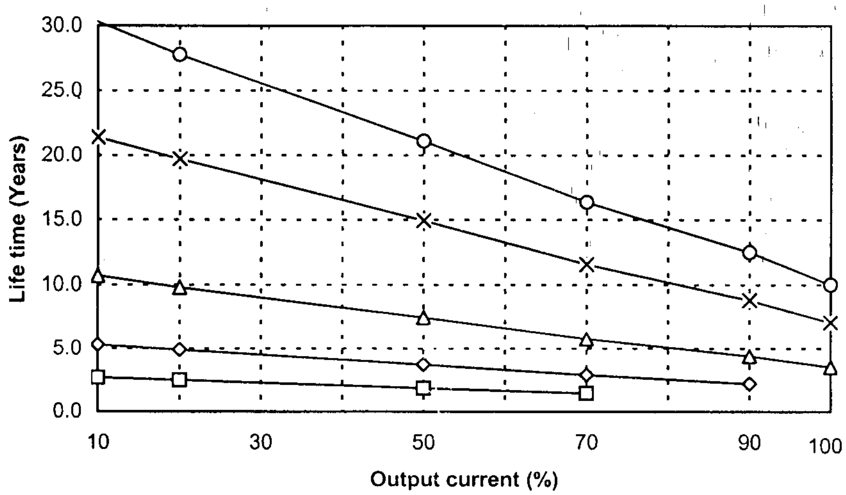
LOAD %	Life time (years) Ta (℃)				
	25.0	30.0	40.0	50.0	60.0
10	30.3	21.4	10.7	5.3	2.7
20	27.8	19.7	9.8	4.9	2.5
50	21.1	14.9	7.5	3.7	1.9
70	16.3	11.5	5.8	2.9	1.4
90	12.5	8.8	4.4	2.2	—
100	10.0	7.1	3.5	—	—

$$L = Lo \times 2^{(105 - Tc)/10} \quad (\text{Yrs})$$

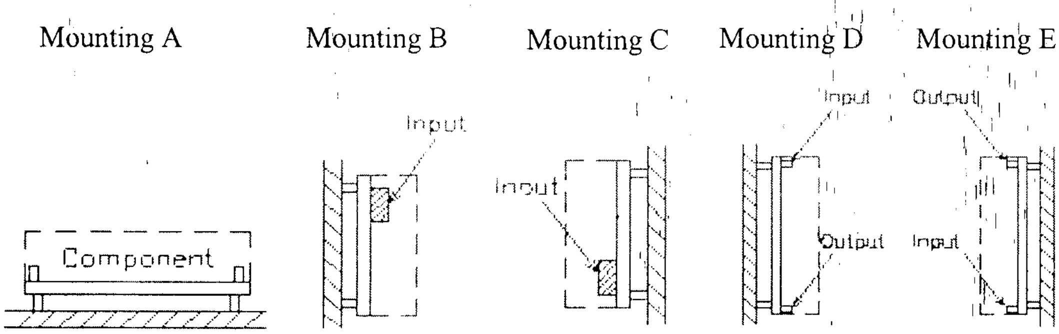
L : Elec. Capacitor computed life (24 Hrs / day , 365 days / year)

Lo : Guarantee life for Elec. Capacitor

Tc(ΔT+Ta) : Case temperature of Elec. Capacitor



Ta=25℃ —○— Ta=30℃ —×— Ta=40℃ —△— Ta=50℃ —◇— Ta=60℃ —□—



5. ABNORMAL TEST

MODEL: VS30C-5

(1) Test Conditions

Input : 132VAC Output : 5V / 6A Ta : 25°C , 70%RH

(2) Test Results

No.	Test position		Test Mode		Test Results												
					1	2	3	4	5	6	7	8	9	10	11	12	
	Location No.	Test Point	SHORT	OPEN	FIRE	SMOKE	BURST	SMELL	Red Hot	DAMAGE	Fuse Blown	OVP	OCP	No Out-put	No Change	OTHERS	Note
1	Q1	D-G	Y								Y			Y			Q1,ZD2 SHORTED
2		D-S	Y								Y			Y			
3		G-S	Y											Y			
4		D		Y										Y			
5		S		Y										Y			
6		G		Y							Y			Y			Q1 SHORTED
7	Q2	C-E	Y											Y			
8		B-C	Y											Y			
9		B-E	Y								Y			Y			Q1 SHORTED
10		E		Y							Y			Y			Q1 SHORTED
11		C		Y							Y			Y			Q1 SHORTED
12		B		Y							Y			Y			Q1 SHORTED
13	A1	K-A	Y													Y	O/P LOW
14		K-R	Y													Y	O/P LOW
15		R-A	Y									Y		Y			ZD4 SHORTED
16		K		Y								Y		Y			ZD4 SHORTED
17		A		Y								Y		Y			ZD4 SHORTED
18		R		Y								Y		Y			ZD4 SHORTED
19	PC1	1-2	Y									Y		Y			ZD4 SHORTED
20		3-4	Y											Y			
21		1		Y								Y		Y			ZD4 SHORTED
22		2		Y								Y		Y			ZD4 SHORTED
23		3		Y								Y		Y			ZD4 SHORTED
24		4		Y								Y		Y			ZD4 SHORTED
25	D1		Y								Y			Y			
26				Y										Y			
27	D2		Y								Y			Y			Q1 SHORTED
28				Y										Y			
29	D3		Y													Y	O/P LOW
30				Y											Y		

No.	Test position: Location No.	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 Blown	8 OVP	9 OCP	10 No Out-put	11 No Change	12 OTHERS	Note
31	D4		Y												Y		
32				Y											Y		
33	ZD1		Y												Y		
34				Y											Y		
35	ZD2		Y											Y			
36				Y											Y		
37	ZD3		Y													Y	O/P LOW
38				Y											Y		
39	ZD4		Y											Y			
40				Y											Y		
41	T1	2-3	Y								Y			Y			
42		3-4	Y											Y			
43		4-5	Y								Y			Y			
44		6-7	Y												Y		
45		7-8	Y												Y		
46		8-9	Y											Y			
47		9-10	Y												Y		
48		2		Y										Y			
49		3		Y										Y			
50		4		Y										Y			
51		5		Y										Y			
52		6		Y											Y		
53		7		Y											Y		
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6. VIBRATION TEST

MODEL : VS30C-5

(1) Vibration test class

Frequency variable endurance test

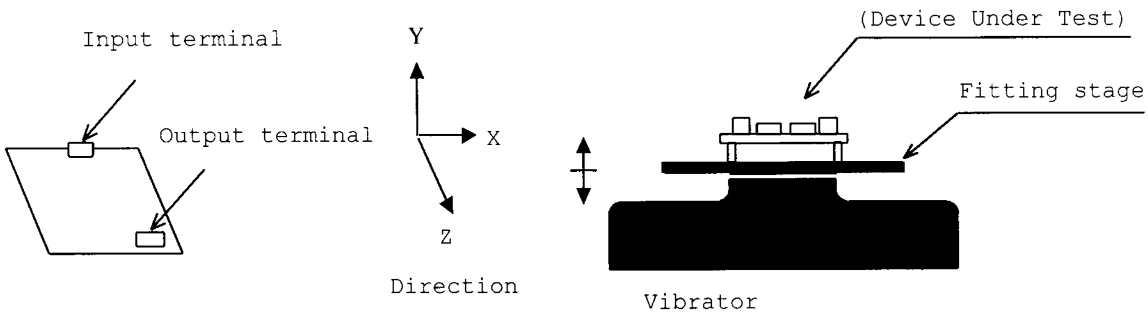
(2) Equipment used

EMIC CORP Controller : F-400-BM-DCS-7800 Vibrator 905-FN

(3) Test Conditions

Sweep frequency	10 ~ 55Hz
Sweep time	1 minute
Acceleration	Constant (2G)
Direction	X, Y, Z.
Test time	1 hour each

(4) Test method



(5) Test Results

O K

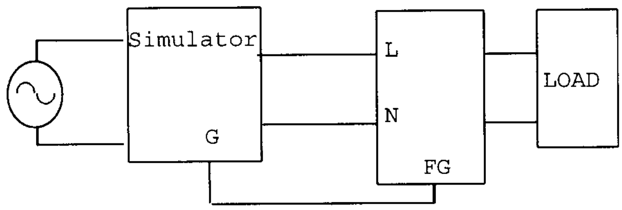
Check item		Output voltage (V)	Ripple voltage(mVp-p)	Visual Check
Before Test		5.028	15	O.K.
After Test	X	5.029	15	O.K.
	Y	5.027	15	O.K.
	Z	5.027	15	O.K.

Check conditions: Vin: 100Vac, Iout: 100%

7. NOISE SIMULATE TEST

MODEL : VS30C-5

(1) Test circuit and equipment



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

(2) Test Conditions

* Input voltage	: 100VAC	* Noise level	: 0V~2KV
* Output voltage	: Rated	* Phase shift	: 0° ~ 360°
* Output current	: 0% , 100%	* Polarity	: + , -
* Ambient temperature	: 25°C	* Mode	: Normal Common
* Pulse width	: 50ns ~ 1000ns	* Trig select	: Line

(3) Acceptable conditions

1. Not to be broken
2. Not to be shut down output
3. No other out of orders

(4) Test Result

O K