

Z⁺400 H.V Series

RELIABILITY

DATA

DWG No.: IA779-79-01		
APPD	CHK	DWG
<i>F</i> 23/12/13	<i>Por B.</i> 17/12/13	<i>Gavin</i> 24/11/13

INDEX**PAGE**

1. MTBF; Calculated value of MTBF	R-1
2. Components derating	R-2~6
3. Main components temperature rise	R-7
4. Electrolytic capacitors computed life	R-8
5. Abnormal test	R-9
6. Vibration test	R-10
7. Noise simulation test	R-11
8. Thermal shock test	R-12
9. Fan life expectancy	R-13

Terminology used

FG..... Frame Ground

*The above data is typical value. As all units have nearly the same characteristics, the data to be considered as ability value.

1. Calculated value of MTBF

MODEL : 160V-2.6A

(1) Calculating Method

Method of calculation according to MIL-HDBK-217F.

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

Formula:

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

Where:

λ_{equip} = Total Equipment Failure Rate (Failures / 10^6 Hours)

λ_G = Generic Failure Rate For The i th Generic Part (Failure / 10^6 Hours)

N_i = Quantity of i th Generic Part

n = Number of Different Generic Part Categories

π_Q = Generic Quality factor for the i th Generic Part ($\pi_Q = 1$)

(2) MTBF Values

G_F : (GROUND, FIXED)

MTBF = 75,667 (HOURS)

(MTBF calculation for fan isn't included.)

2. Components derating

MODEL : 160V-2.6A

(1) Calculation method

1. Measuring Conditions

Input: 100 , 200Vac

Ambient temperature: 50°C

Output: 160V - 2.6A (100%)

Mounting Method: Standard Mounting

2. Semiconductors

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

3. IC, Resistors, Capasitors, etc.

Ambient temperature, operating conditions, power dissipation and so on are within derating criteria.

4. Calculation Method of Thermal Impedance:

$$\Theta_{j-c} = \frac{T_{j(max)} - T_c}{P_{c(max)}} \quad \Theta_{j-a} = \frac{T_{j(max)} - T_a}{P_{c(max)}}$$

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

$P_{c(max)}$: Maximum power dissipation

$T_{j(max)}$: Maximum junction temperature

Θ_{j-c} : Thermal impedance between junction and case

Θ_{j-a} : Thermal impedance between junction and air

(2) Component derating list

Z400 H.V

Location No.	Vin = 100Vac Load=100% Ta=50°C					
A101 L4981AD013TR ST	Tjmax=	150 °C	$\theta_{j-a} =$	120.0 °C/W		
	Pd =	0.23 W	$\Delta T_a =$	25.0 °C	Ta =	75.0 °C
	Tj = Ta + ($\theta_{j-a} \times Pd$) =>		Tj =	102.6 °C	D.F. =	68.4 %
D101 D25XB60-7000 SHINDENGEN	Tjmax=	150 °C	$\theta_{j-c} =$	1.0 °C/W		
	Pd =	8.0 W	$\Delta T_c =$	52.0 °C	Tc =	102.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	110.0 °C	D.F. =	73.3 %
D106 STTH806DTI ST	Tjmax=	150 °C	$\theta_{j-c} =$	2.6 °C/W		
	Pd =	3.0 W	$\Delta T_c =$	42.0 °C	Tc =	92.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	99.8 °C	D.F. =	66.5 %
D116 IDH02SG120 INFINEON	Tjmax=	175 °C	$\theta_{j-c} =$	2.0 °C/W		
	Pd =	2.90 W	$\Delta T_c =$	57.0 °C	Tc =	107.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	112.8 °C	D.F. =	64.5 %
Q101 IPW60R099CP INFINEON	Tjmax=	150 °C	$\theta_{j-c} =$	0.5 °C/W		
	Pd =	8.60 W	$\Delta T_c =$	36.7 °C	Tc =	86.7 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	91.0 °C	D.F. =	60.7 %
Q105 IPP60R099CP INFINEON	Tjmax=	150 °C	$\theta_{j-c} =$	0.8 °C/W		
	Pd =	3.91 W	$\Delta T_c =$	40.6 °C	Tc =	90.6 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	93.7 °C	D.F. =	62.5 %
SC101 CR12CM-12A B00 RENESAS	Tjmax=	125 °C	$\theta_{j-c} =$	1.2 °C/W		
	Pd =	2.0 W	$\Delta T_c =$	29.2 °C	Tc =	79.2 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	81.5 °C	D.F. =	65.2 %
PC101 PS2801-1-F3-A(P) NEC	Tjmax=	125 °C	$\theta_{j-c} =$	1666.7 °C/W		
	Pd =	0.00 W	$\Delta T_c =$	19.6 °C	Tc =	69.6 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	69.6 °C	D.F. =	55.7 %
Q117 FMH09N90E FUJI	Tjmax=	150 °C	$\theta_{j-c} =$	0.61 °C/W		
	Pd =	0.0 W	$\Delta T_c =$	24.0 °C	Tc =	74.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	74.0 °C	D.F. =	49.3 %

Location No.	Vin=100Vac Load=100% Ta=50°C					
A109 AD7798BRUZ ANALOG DEVICES	Tjmax= Pd = Tj = Tc + (θ j-c x Pd) =>	150 °C 0.002 W	θj-c = ΔTc = Tj =	14.0 °C/W 20.0 °C 70.0 °C	Tc = D.F. =	70.0 °C 46.7 %
A110 DAC8830ICDRG4 TI	Tjmax= Pd = Tj = Ta + (θ j-a x Pd) =>	150 °C 1E-04 W	θj-a = ΔTa = Tj =	136.9 °C/W 20.0 °C 70.0 °C	Ta = D.F. =	70.0 °C 46.7 %
A115 STM32F105VCT6TR ST	Tjmax= Pd = Tj = Ta + (θ j-a x Pd) =>	150 °C 0.434 W	θj-a = ΔTa = Tj =	46.0 °C/W 15.0 °C 90.2 °C	Ta = D.F. =	70.2 °C 60.1 %
A126 L4941BV ST	Tjmax= Pd = Tj = Tc + (θ j-c x Pd) =>	150 °C 0.6 W	θj-c = ΔTc = Tj =	3.0 °C/W 10.4 °C 62.2 °C	Tc = D.F. =	60.4 °C 41.5 %
A127 LM3940IT-3.3NOPB NATIONAL	Tjmax= Pd = Tj = Tc + (θ j-c x Pd) =>	125 °C 0.5 W	θj-c = ΔTc = Tj =	4.0 °C/W 11.7 °C 63.7 °C	Tc = D.F. =	61.7 °C 51.0 %
A141 LM78L15ACM NOPB NATIONAL	Tjmax= Pd = Tj = Ta + (θ j-a x Pd) =>	125 °C 0.1 W	θj-a = ΔTa = Tj =	180.0 °C/W 21.4 °C 89.4 °C	Ta = D.F. =	71.4 °C 71.5 %
A142 MIP2E5DMY MATSUSHITA	Tjmax= Pd = Tj = Tc + (θ j-c x Pd) =>	150 °C 1.4 W	θj-c = ΔTc = Tj =	3.0 °C/W 30.2 °C 84.4 °C	Tc = D.F. =	80.2 °C 56.3 %
A145 LM78L05ACMNOPB NATIONAL	Tjmax= Pd = Tj = Ta + (θ j-a x Pd) =>	125 °C 0.08 W	θj-a = ΔTa = Tj =	231.0 °C/W 16.2 °C 84.7 °C	Ta = D.F. =	66.2 °C 67.8 %
D122 CRH01(TE85L,Q) TOSHIBA	Tjmax= Pd = Tj = Tc + (θ j-c x Pd) =>	150 °C 0.06 W	θj-c = ΔTc = Tj =	130.0 °C/W 24.7 °C 82.5 °C	Tc = D.F. =	74.7 °C 55.0 %
D130 CRH01(TE85L,Q) TOSHIBA	Tjmax= Pd = Tj = Tc + (θ j-c x Pd) =>	150 °C 0.03 W	θj-c = ΔTc = Tj =	130.0 °C/W 25.0 °C 78.9 °C	Tc = D.F. =	75.0 °C 52.6 %
D136 CRH01(TE85L,Q) TOSHIBA	Tjmax= Pd = Tj = Tc + (θ j-c x Pd) =>	150 °C 0.03 W	θj-c = ΔTc = Tj =	130.0 °C/W 19.6 °C 73.5 °C	Tc = D.F. =	69.6 °C 49.0 %
Q116 IPD135N03L G INFINEON	Tjmax= Pd = Tj = Tc + (θ j-c x Pd) =>	150 °C 0.01 W	θj-c = ΔTc = Tj =	6.3 °C/W 36.0 °C 86.1 °C	Tc = D.F. =	86.0 °C 57.4 %
PC106 PS2581L2-E3-A(D) NEC	Tjmax= Pd = Tj = Ta+ (θ j-a x Pd) =>	125 °C 0.004 W	θj-a = ΔTa = Tj =	666.7 °C/W 9.0 °C 61.7 °C	Ta = D.F. =	59.0 °C 49.3 %
PC109 PS2801-1-F3-A(P) NEC	Tjmax= Pd = Tj = Ta+ (θ j-a x Pd) =>	125 °C 0.001 W	θj-a = ΔTa = Tj =	1666.7 °C/W 10.0 °C 61.7 °C	Ta = D.F. =	60.0 °C 49.3 %
PC117 PS2801-1-F3-A(P) NEC	Tjmax= Pd = Tj = Ta+ (θ j-a x Pd) =>	125 °C 0.001 W	θj-a = ΔTa = Tj =	1666.7 °C/W 10.0 °C 61.7 °C	Ta = D.F. =	60.0 °C 49.3 %

(2) Component derating list

Z400 H.V

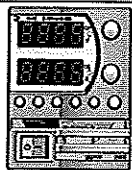
Location No.	Vin = 200Vac Load=100% Ta=50°C					
A101 L4981AD013TR ST	Tjmax=	150 °C	$\theta_{j-a} =$	125.0 °C/W		
	Pd =	0.23 W	$\Delta T_a =$	24.2 °C	Ta =	74.2 °C
	Tj = Ta + ($\theta_{j-a} \times Pd$) =>		Tj =	103.0 °C	D.F. =	68.6 %
D101 D25XB60-7000 SHINDENGEN	Tjmax=	150 °C	$\theta_{j-c} =$	1.0 °C/W		
	Pd =	4.0 W	$\Delta T_c =$	30.5 °C	Tc =	80.5 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	84.5 °C	D.F. =	56.3 %
D106 STTH806DTI ST	Tjmax=	150 °C	$\theta_{j-c} =$	2.6 °C/W		
	Pd =	0.6 W	$\Delta T_c =$	28.4 °C	Tc =	78.4 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	80.0 °C	D.F. =	53.3 %
D116 IDH02SG120 INFINEON	Tjmax=	175 °C	$\theta_{j-c} =$	2.0 °C/W		
	Pd =	2.90 W	$\Delta T_c =$	55.0 °C	Tc =	105.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	110.8 °C	D.F. =	63.3 %
Q101 IPW60R099CP INFINEON	Tjmax=	150 °C	$\theta_{j-c} =$	0.5 °C/W		
	Pd =	4.00 W	$\Delta T_c =$	20.0 °C	Tc =	70.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	72.0 °C	D.F. =	48.0 %
Q105 IPP60R099CP INFINEON	Tjmax=	150 °C	$\theta_{j-c} =$	0.8 °C/W		
	Pd =	3.91 W	$\Delta T_c =$	40.0 °C	Tc =	90.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	93.1 °C	D.F. =	62.1 %
SC101 CR12CM-12A B00 RENESAS	Tjmax=	125 °C	$\theta_{j-c} =$	1.2 °C/W		
	Pd =	1.0 W	$\Delta T_c =$	20.0 °C	Tc =	70.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	71.2 °C	D.F. =	57.0 %
PC101 PS2801-1-F3-A(P) NEC	Tjmax=	125 °C	$\theta_{j-c} =$	1666.70 °C/W		
	Pd =	0.00 W	$\Delta T_c =$	15.8 °C	Tc =	65.8 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	65.8 °C	D.F. =	52.6 %
Q117 FMH09N90E FUJI	Tjmax=	150 °C	$\theta_{j-c} =$	0.61 °C/W		
	Pd =	0.0 W	$\Delta T_c =$	19.8 °C	Tc =	69.8 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	69.8 °C	D.F. =	46.5 %

Location No.	Vin=200Vac Load=100% Ta=50°C				
A109 AD7798BRUZ ANALOG DEVICES	Tjmax=	150 °C	$\theta_{j-c} =$	14.0 °C/W	
	Pd =	0.002 W	$\Delta T_c =$	19.0 °C	Tc = 69.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	69.0 °C	D.F. = 46.0 %
A110 DAC8830ICDRG4 TI	Tjmax=	150 °C	$\theta_{j-a} =$	136.9 °C/W	
	Pd =	1E-04 W	$\Delta T_a =$	19.0 °C	Ta = 69.0 °C
	Tj = Ta + ($\theta_{j-a} \times Pd$) =>		Tj =	69.0 °C	D.F. = 46.0 %
A115 STM32F105VCT6TR ST	Tjmax=	150 °C	$\theta_{j-a} =$	46.0 °C/W	
	Pd =	0.434 W	$\Delta T_a =$	14.0 °C	Ta = 68.1 °C
	Tj = Ta + ($\theta_{j-a} \times Pd$) =>		Tj =	88.1 °C	D.F. = 58.7 %
A126 L4941BV ST	Tjmax=	150 °C	$\theta_{j-c} =$	3.0 °C/W	
	Pd =	0.2 W	$\Delta T_c =$	10.0 °C	Tc = 60.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	60.6 °C	D.F. = 40.4 %
A127 LM3940IT-3.3NOPB NATIONAL	Tjmax=	125 °C	$\theta_{j-c} =$	4.0 °C/W	
	Pd =	0.2 W	$\Delta T_c =$	11.4 °C	Tc = 61.4 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	62.2 °C	D.F. = 49.8 %
A141 LM78L15ACM NOPB NATIONAL	Tjmax=	125 °C	$\theta_{j-a} =$	180.0 °C/W	
	Pd =	0.1 W	$\Delta T_a =$	20.4 °C	Ta = 70.4 °C
	Tj = Ta + ($\theta_{j-a} \times Pd$) =>		Tj =	88.4 °C	D.F. = 70.7 %
A142 MIP2E5DMY MATSUSHITA	Tjmax=	150 °C	$\theta_{j-c} =$	3.0 °C/W	
	Pd =	1.4 W	$\Delta T_c =$	18.1 °C	Tc = 79.7 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	83.9 °C	D.F. = 55.9 %
A145 LM78L05ACMNOBP NATIONAL	Tjmax=	125 °C	$\theta_{j-a} =$	231.0 °C/W	
	Pd =	0.08 W	$\Delta T_a =$	15.0 °C	Ta = 65.0 °C
	Tj = Ta + ($\theta_{j-a} \times Pd$) =>		Tj =	83.5 °C	D.F. = 66.8 %
D122 CRH01(TE85L,Q) TOSHIBA	Tjmax=	150 °C	$\theta_{j-c} =$	130.0 °C/W	
	Pd =	0.06 W	$\Delta T_c =$	24.3 °C	Tc = 74.3 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	82.1 °C	D.F. = 54.7 %
D130 CRH01(TE85L,Q) TOSHIBA	Tjmax=	150 °C	$\theta_{j-c} =$	130.0 °C/W	
	Pd =	0.03 W	$\Delta T_c =$	24.5 °C	Tc = 74.5 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	78.4 °C	D.F. = 52.3 %
D136 CRH01(TE85L,Q) TOSHIBA	Tjmax=	150 °C	$\theta_{j-c} =$	130.0 °C/W	
	Pd =	0.03 W	$\Delta T_c =$	19.0 °C	Tc = 69.0 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	72.9 °C	D.F. = 48.6 %
Q129 2SK4033 TOSHIBA	Tjmax=	150 °C	$\theta_{j-c} =$	6.3 °C/W	
	Pd =	0.01 W	$\Delta T_c =$	31.3 °C	Tc = 81.3 °C
	Tj = Tc + ($\theta_{j-c} \times Pd$) =>		Tj =	81.4 °C	D.F. = 54.2 %
PC106 PS2581L2-E3-A(D) NEC	Tjmax=	125 °C	$\theta_{j-a} =$	666.70 °C/W	
	Pd =	0.004 W	$\Delta T_a =$	8.0 °C	Ta = 58.0 °C
	Tj = Ta + ($\theta_{j-a} \times Pd$) =>		Tj =	60.7 °C	D.F. = 48.5 %
PC109 PS2801-1-F3-A(P) NEC	Tjmax=	125 °C	$\theta_{j-a} =$	1666.00 °C/W	
	Pd =	0.001 W	$\Delta T_a =$	9.0 °C	Ta = 59.0 °C
	Tj = Ta + ($\theta_{j-a} \times Pd$) =>		Tj =	60.7 °C	D.F. = 48.5 %
PC117 PS2801-1-F3-A(P) NEC	Tjmax=	125 °C	$\theta_{j-a} =$	1666.00 °C/W	
	Pd =	0.001 W	$\Delta T_a =$	9.0 °C	Ta = 59.0 °C
	Tj = Ta + ($\theta_{j-a} \times Pd$) =>		Tj =	60.7 °C	D.F. = 48.5 %

3. Main components temperature rise

MODEL : 160V-2.6A

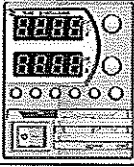
Condition:

Standard Mounting	
Output Voltage	160V
Output Current	2.60A
Ta	50°C

Location No.	Parts Name	ΔT Temperature Rise (°C)	
		100Vac	200Vac
A101	CHIP PFC IC	25.0	24.2
C101	FILM CAPACITOR	24.0	15.5
C102	FILM CAPACITOR	25.5	16.3
C103	CERAMIC CAPACITOR	25.0	15.6
C105	FILM CAPACITOR	30.2	24.7
C111	FILM CAPACITOR	17.1	12.2
C113	CERAMIC CAPACITOR	5.1	4.6
C115	ELEC. CAPACITOR	15.6	13.1
C501	ELEC. CAPACITOR	27.1	25.0
D101	BRIDGE	52.0	30.5
D106	DIODE	42.0	28.4
D116	DIODE	57.0	55.0
D117	DIODE	56.5	55.2
F101	FUSE	30.9	16.4
L101	COMMON CHOKE	32.7	17.4
L102	COMMON CHOKE	30.3	17.8
L103	PF CHOKE	45.7	42.0
L104	CHOKE	48.8	46.1
PC101	OPTO COUPLER	19.6	15.8
Q101	MOSFET	20.0	6.0
Q105	MOSFET	40.4	40.6
R500	RES. SHUNT	32.7	31.4
T101	TRANSFORMER	40.8	40.4
T102	TRANSFORMER	18.4	17.7
T103	TRANSFORMER	22.2	21.6
A108	DIGITAL ISOLATOR	16.8	15.3
A115	MICROCONTROLLER	20.2	18.1
A141	LINEAR REGULATOR	18.0	17.0
A142	TOP SWITCH	30.2	29.7
A145	LINEAR REGULATOR	16.2	15.0
D125	DIODE	15.0	13.9
D130	DIODE	25.0	24.5
D133	DIODE	19.6	19.3
T201	TRANSFORMER	17.9	17.3
ZD116	ZENER	18.4	17.1
ZD123	ZENER	14.1	13.7

4. Electrolytic capacitor lifetime

Condition:

Standard Mounting	
Input Voltage	100Vac

LOAD (%)	COMPUTED LIFE (year) at T(ambient)		
	30°C	40°C	50°C
20	10.0	10.0	10.0
40	10.0	10.0	10.0
60	10.0	10.0	9.3
80	10.0	10.0	8.1
100	10.0	10.0	5.1

5. Abnormal test

MODEL : 650V-0.64A

(1) Test condition and circuit:

Input Voltage: 100Vac

Output: 650V 0.64A

Ta : 50°C

(2) Test results

No.	Test Position		Test Mode		Test Result												
	Location	Test point	Short	Open	1	2	3	4	5	6	7	8	9	10	11	12	Note
					Fire	Smoke	Burst	Smell	Red hot	Damaged	Fuse open	OVP	OVP	No output	No change	Others	
1	C115		•							•			•			F101	
2	D101	1-2	•							•			•			F101	
		2-4	•							•			•			F101	
3	D104	A-K	•						•							R123	
4	D106	A-K	•						•	•			•			D103, F101, Q101	
5	D107	A-K	•												•	Pin decreased to 283W	
6	D116	A-K	•												•	Pin decreased to 46W	
7	Q101	D-G	•						•	•			•			F101, Q101	
		D-S	•							•			•			F101	
		G		•					•	•			•			F101, Q101	
8	Q102	C-E	•						•							R135, R136	
9	Q104	D-G	•						•	•			•			F101, Q104, Q105	
		D-S	•						•	•			•			F101, Q104, Q106, Q107	
		G		•					•	•			•			F101, Q104, Q105	
10	Q108	C-E	•												•	Pin decreased to 63W	
11	Q112	C-E	•										•				
		D-S	•						•			•				Q117, Q118, R191, R192, R193, R196	
12	Q117	D-S	•						•			•					Q118, R191, R192, R193, R194, R196, R206
		D-G	•						•			•					
13	R125			•											•	Pin increased to 508W	
14	SC101	2		•					•	•			•			F101, Q101, R123	
15	T101	1-3	•								•		•				
1	A126	1-2	•										•			No Display, No Fan	
2	A141	2-8	•										•			No Display, No Fan	
3	A142	1		•									•			No Display, No Fan	
1-3		•						•	•			•				A142, F101, ZD101	
2-3		•								•			•			F101	
4	A143	3-5	•								•					Vo: 680V, Pin: 520W, OVP fault after 4min.	
5	A145	2-8	•						•				•			No Fan, D136	
6	D126	A-K	•										•			No Display, No Fan	
7	D123	A-K	•										•			No Display, No Fan	
8	D130	A-K	•										•			No Display, No Fan	
9	D135	A-K	•										•			No Display, No Fan	
10	D136	A-K	•										•			No Display, No Fan	
1	C500		•						•	•			•			Main fuse has blown after 4min. F101, L104, Q106, Q107	
2	C502		•						•							Pin decreased to 100W. L104	
3	D500	A-K	•												•	Pin: 541W, Vo: 682.5V, Io: 0.017A	

6. Vibration test

MODEL: 650V-0.64A

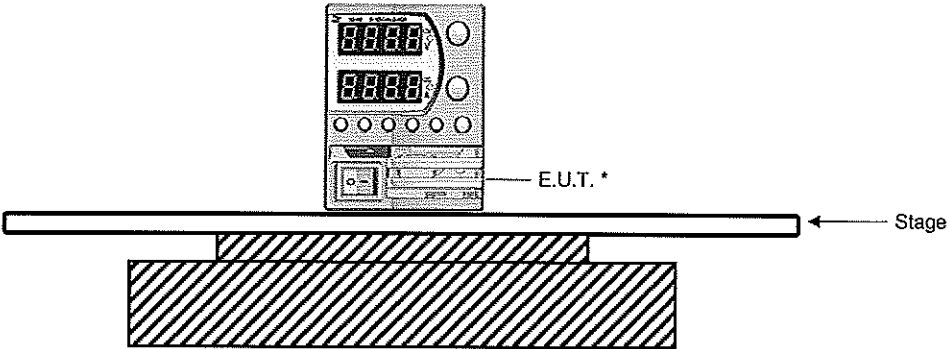
(1) Vibration test class

Frequency variable endurance test

(2) Equipment used

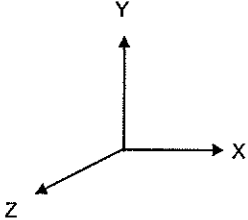
Name	Manufacturer	Model
Vibration Test System	Ling Dynamic Systems	V875
Laser Shaker Control System	DACTRON	LASER
Isotron Accelerometer 98.2 mV/g	Dytran instruments Inc.	3256A2
Isotron Accelerometer 101.7 mV/g	Dytran instruments Inc.	3049E3

(3) Testing method



Test condition:

Sweep frequency: 5~500Hz
 Acceleration: 1.07G
 Direction: X, Y, Z
 Test time: 1 hour per each axis



*E.U.T. is fixed to vibrator surface by mounting straps

(4) Test result OK

Check item	Output Voltage (V)	Ripple (mVp-p)	E.U.T. state
Before test	650.01	91.67	O.K.
Direction			
X	650.02	110.00	O.K.
Y	650.04	100.33	O.K.
Z	650.04	96.67	O.K.

7. Noise Simulation Test

MODEL : 320V-1.3A

(1) Test equipment:

NoiseKen INS - 4040 impulse noise simulator
 NoiseKen IJ - 4050 coupling decoupling network

(2) Acceptance criteria:

1. No damage to PS
2. No output shutdown
3. No other abnormalities

(3) Test condition:

Ta=25°C

Noise level - \pm (0.6kV, 1.2kV, 1.8kV, 2kV) (50 Ω term.)

Pulse width - 50ns ~ 1us

Injection phase (AC input only) - 0°~360° (with step 45°)

Input voltage - 230Vac 50Hz

Output Current - 100%

Output Voltage - Rated

(4) Test result:

OK

1. No damage to PS
2. No output shutdown
3. No other abnormalities

Pulse	Polarity	Line-Neutral	Line-FG	Neutral-FG
2kV	+	OK		
2kV	-	OK		
2kV	+		OK	OK
2kV	-		OK	OK

(1) Test Equipment

Thermal Shock Chamber: TSA-101S-W , ESPEC

(2) The number of D.U.T. (Device Under Test)

1 (unit)

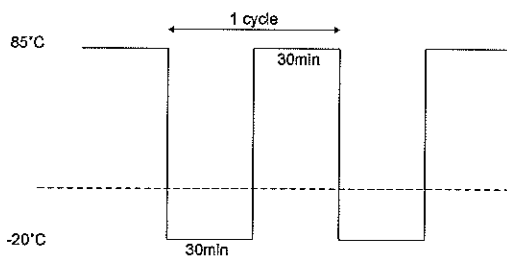
(3) Test condition

Ambient temperature: -20°C <=> +85°C

Test time: Refer to Dwg.

Test cycle: 100cycles

Not operating



(4) 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. Later leave it for 1hour at room temperature, then check if there is no abnormal output.

(5) Test Result **OK**

Vin:100Vac

Before testing			After testing		
Vout-100%, Iout-100%	Vout-100%, Iout-0%	P-t-P	Vout-100%, Iout-100%	Vout-100%, Iout-0%	P-t-P
319.962V	319.960V	56mV	319.934V	319.933V	55mV

9. Fan Life Expectancy

(1) Part name

9A0612S4D041 (SANYO DENKI CO.)

(2) Life expectancy

The data shows fan life expectancy for fan only by manufacture (90% survival rate).

Fig1. shows measuring point of ambient temperature.

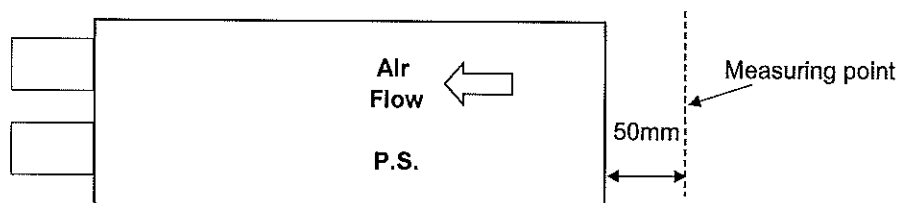
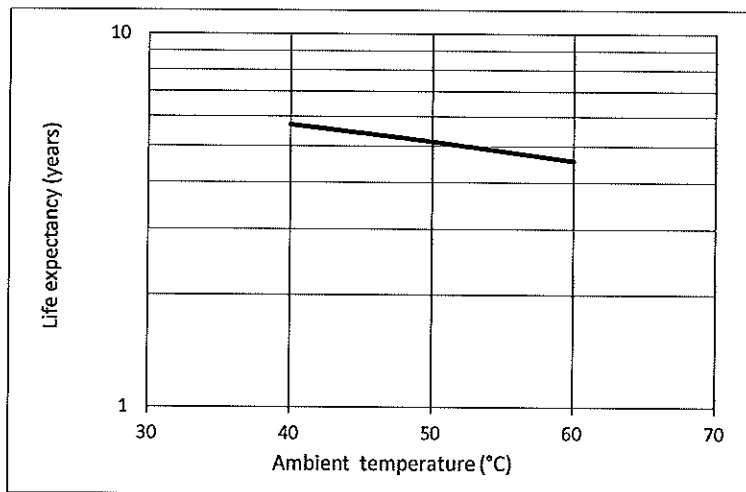


Fig1.Measuring point of fan ambient temperature.

$$1 \text{ year} = 365 \text{ day} \times 24 \text{ hours/day} = 8760 \text{ hours}$$