Test Report: LRS-100-48

100W Single Output Switching Power Supply

■ DESIGN VERIFY TEST

Output Function Test
Input Function Test
Protection Function Test
Component Stress Test

■ SAFETY & E.M.C. TEST

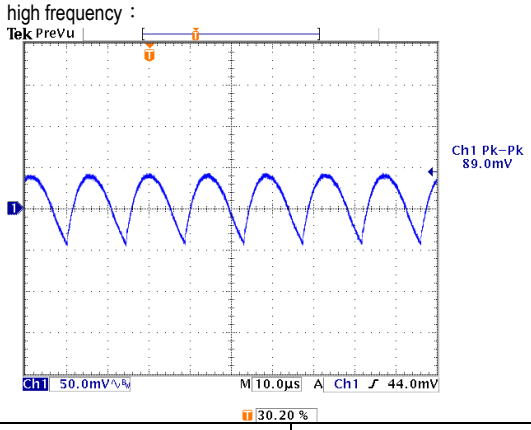
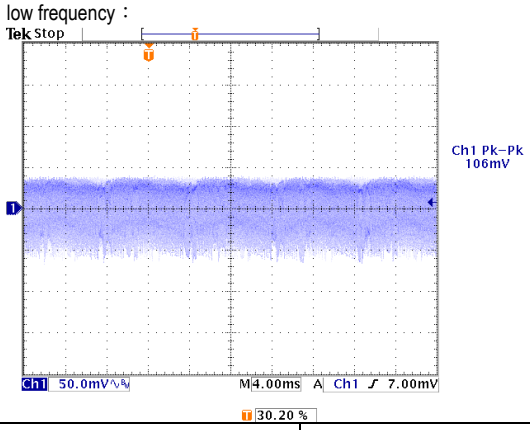
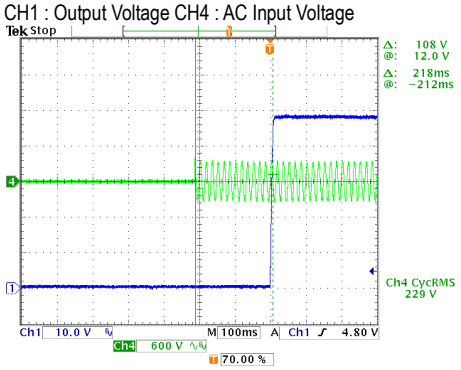
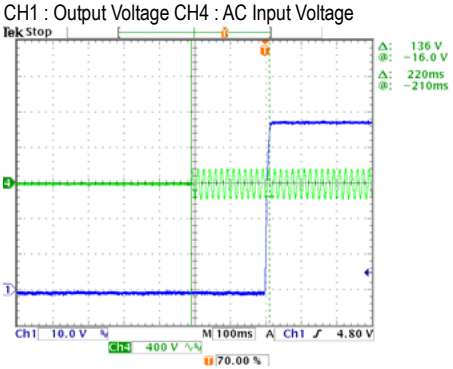
Safety Test
E.M.C. Test

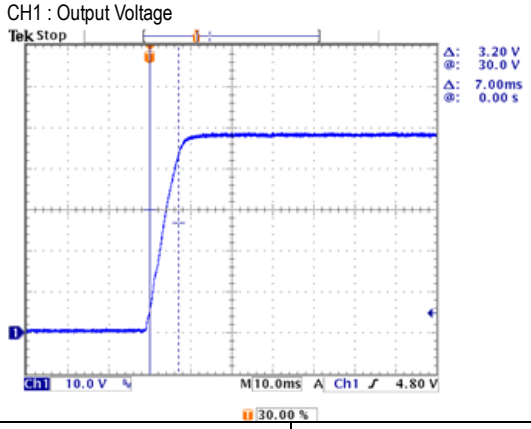
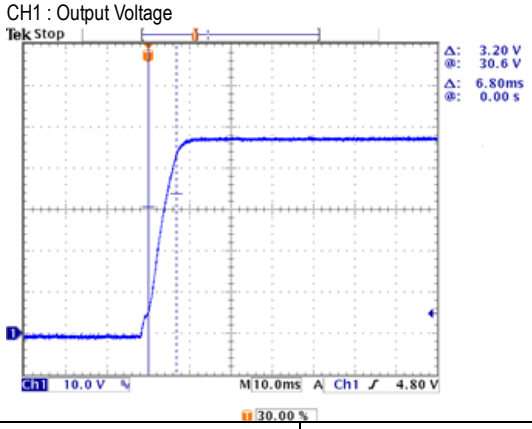
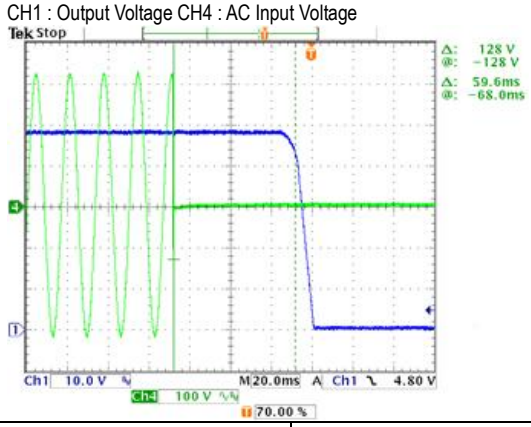
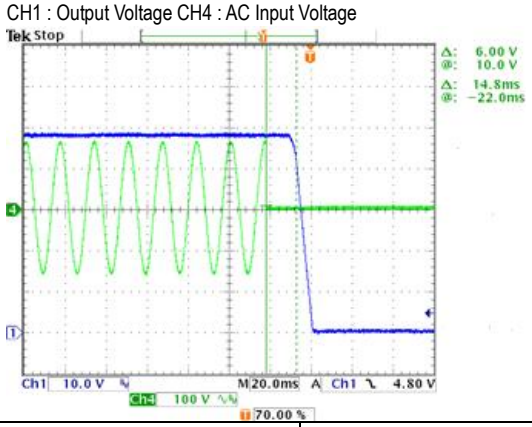
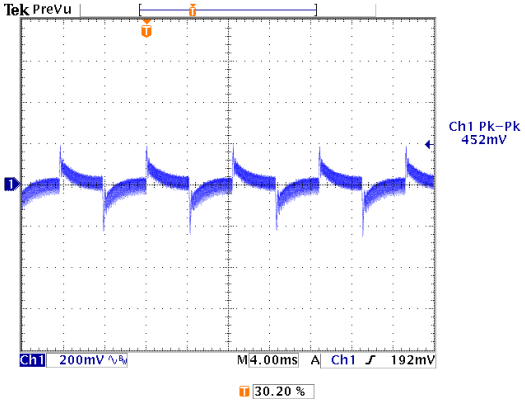
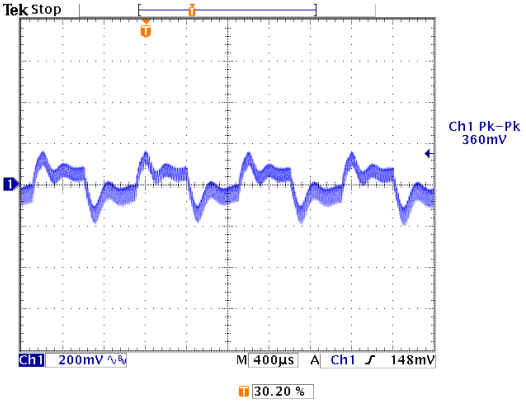
■ RELIABILITY TEST

ENVIRONMENT TEST

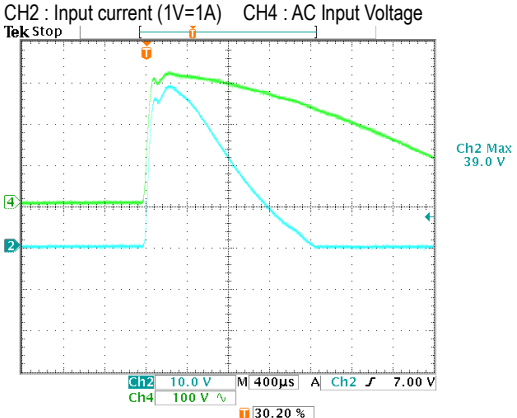
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

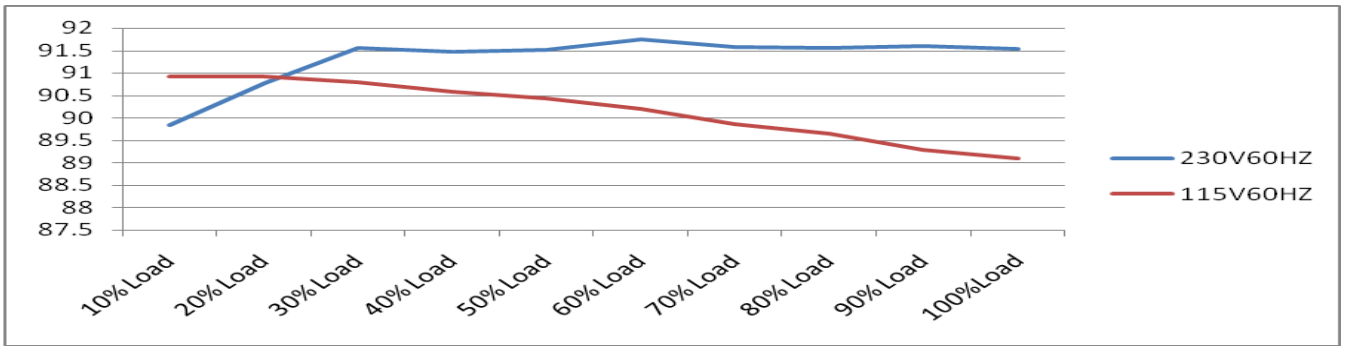
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1:43.2 V~ 52.8 V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	50.685V~55.101V/230VAC 40.684V~54.344V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1 %~ 1 %	I/P: 100VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1:- 0.042 %~ 0.042%
3	LINE REGULATION (Max)	V1:- 0.5 %~ 0.5 %	I/P: 100VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1:-0.021 %~- 0.021%
4	LOAD REGULATION(Max)	V1: -0.5 %~0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0 %~ 0%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	<5%
6	RIPPLE & NOISE(Max)	V1: 200 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 106mVp-p
	high frequency：  low frequency： 			
7	SET UP TIME(Max)	230VAC/500ms 115VAC/ 500ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 218ms 220VAC/ 220ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH4 : AC Input Voltage  INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH4 : AC Input Voltage 			

8	RISE TIME (Max)	230VAC/ 30ms 115VAC/ 30ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 7.00ms 115VAC/6.80ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
9	HOLD UP TIME(Typ)	230VAC/ 5ms 115VAC/ 10ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 59.6ms 115VAC/ 14.8ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH4 : AC Input Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH4 : AC Input Voltage 	
10	DYNAMIC LOAD	V1: 4800 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	 452mVp-p 360mVp-p
	FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 	

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC~264VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	77V~264V
			I/P: (1)LOW-LINE-3V=167 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD ON: 30 Sec OFF: 30 Sec 10MIN (2)230Vac ON: 0.5 Sec OFF: 0.5 Sec 20MIN (3)230Vac ON:3Sec OFF:3Sec 12HOURS (POWER ON/OFF NO DAMAGE)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:170 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ)	230V/ 1.2A 115V/ 1.9A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =1.08A/ 230VAC I =1.82A/ 115VAC
4	LEAKAGE CURRENT	< 0.75 mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	L-FG： 0.317 mA N-FG： 0.317 mA
5	NO LOAD CONSUMPTION	< 0.3 W	I/P：115VAC I/P：230VAC O/P：NO LOAD Ta：25℃	< 0.1692 W < 0.2820 W
6	INRUSH CURRENT(Typ)	230V/50A COLD START	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I =39.0A/ 230VAC
	INPUT=230VAC/50HZ @ FULL LOAD CH2 : Input current (1V=1A) CH4 : AC Input Voltage 			
7	EFFICIENCY(Typ)	91%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	91.53%

EFFICIENCY vs LOAD



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	110%~ 150%	I/P: 230VAC I/P: 115VAC O/P:TESTING Ta:25℃	124.34%/ 230VAC 117.39%/115VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	CH:55.2V~64.8V	I/P: 230VAC I/P: 115VAC O/P:MIN LOAD Ta:25℃	63.2V/ 230VAC 62.4V/115VAC Shut down Re- power ON
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE Hiccup Mode

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q1 Rated 11 A/ 600 V	I/P:High-Line +3V =267V AC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. Ta:25℃	(1)538V (2)536V (3)554V (4)542V (5)540V (6)560V (7)548V
2	Diode Peak **Voltage**	Q101 Rated 20 A / 300 V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8).NO LOAD Ta:25℃	Q101: (1)266V (2)226V (3)265V (4)265V (5)262V (6)265V (7)273V (8)265V
3	**Input Capacitor Voltage**	C5 Rated: 150 μ /400V	I/P:High-Line +3V =267 V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change Ta:25℃	(1)366V (2)368V (3)366V
4	**Control IC Voltage Test**	PWM IC U1 Rated 28 V(MAX) 9.5V(MIN)	I/P:High-Line +3V =267 V AC ON/OFF O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VR Min. LOW LINE Ta:25℃	(1) 21.6V (2) 12.4V (3) 21.2V (4) 25.4V (5) 16.3V
5	Clamp Diode Peak Voltage	D 5 Rated： 800 V 2 A	I/P： High-Line +3V = 267 V AC ON/OFF O/P： (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta： 25℃	(1) 468V (2) 466V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3.75KVAC/min I/P-FG :2KVAC/min O/P-FG:1.25KVAC/min	I/P-O/P: 4.125 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.5 KVAC/min Ta:25℃	I/P-O/P:2.514mA I/P-FG:2.183mA O/P-FG:1.744m A NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25℃	I/P-O/P: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	6mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P: FULL LOAD Ta:25℃	PASS
2	CONDUCTION	EN55022 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL/50% LOAD Ta：25℃	PASS Test by certified Lab
3	RADIATION	EN55022 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL LOAD Ta：25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 INDUSTRY AIR：8KV / Contact：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT： 2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N ： 2KV L,N-PE：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
7	Test by certified Lab & Test Report Prepare			

RELIABILITY TEST

ENVIRONMENT TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL： LRS-100-24
1. ROOM AMBIENT BURN-IN：2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=18.6℃
2. HIGH AMBIENT BURN-IN： 2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=51.9℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 18.6 ℃</th><th>HIGH AMBIENT Ta=51.9 ℃</th></tr>
<tr><td>1</td><td>U1</td><td>46.2℃</td><td>79.1℃</td></tr>
<tr><td>2</td><td>D30</td><td>48.2℃</td><td>81.1℃</td></tr>
<tr><td>3</td><td>LF1</td><td>44.3℃</td><td>78.5℃</td></tr>
<tr><td>4</td><td>BD1</td><td>51.1℃</td><td>83.7℃</td></tr>
<tr><td>5</td><td>C5</td><td>42.7℃</td><td>74.2℃</td></tr>
<tr><td>6</td><td>D5</td><td>52.2℃</td><td>86.6℃</td></tr>
<tr><td>7</td><td>Q1</td><td>51.6℃</td><td>86.6℃</td></tr>
<tr><td>8</td><td>R15</td><td>51.7℃</td><td>86.1℃</td></tr>
<tr><td>9</td><td>C35</td><td>43.0℃</td><td>76.2℃</td></tr>
<tr><td>10</td><td>T1coil</td><td>56.3℃</td><td>89.4℃</td></tr>
<tr><td>11</td><td>T1coil</td><td>60.9℃</td><td>93.7℃</td></tr>
<tr><td>12</td><td>C105</td><td>46.1℃</td><td>78.9℃</td></tr>
<tr><td>13</td><td>Q101</td><td>62.5℃</td><td>94.6℃</td></tr>
<tr><td>14</td><td>L100</td><td>39.0℃</td><td>72.1℃</td></tr>
</table></td></tr>
<tr><td>2</td><td>OVER LOAD BURN-IN TEST</td><td>NO DAMAGE
1 HOUR (MIN)</td><td>I/P： 230 VAC
O/P： 124％LOAD
Ta：25℃</td><td>TEST：OK</td></tr>
<tr><td>3</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2 HOUR</td><td>I/P： 264VAC/100VAC
O/P： 100 ％LOAD
Ta= -30 ℃</td><td>TEST：OK</td></tr>
<tr><td>4</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 50 ℃
NO DAMAGE</td><td>I/P： 272 VAC
O/P： FULL LOAD
Ta= 50 ℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td></tr>
<tr><td>5</td><td>TEMPERATURE
COEFFICIENT</td><td>± 0.03 %/℃(0~50℃)</td><td>I/P： 230 VAC
O/P： FULL LOAD</td><td>0%/℃(0~40℃)</td></tr>
<tr><td>6</td><td>STORAGE TEMPERATURE TEST</td><td colspan="2">1. Thermal shock Temperature： -40℃~ +85℃
2. Temperature change rate ：25℃ / MIN
3. Dwell time low and high temperature ： 30 MIN/EACH
4. Total test cycle：5 CYCLE
5. Input/Output condition： STATIC</td><td>OK</td></tr>
<tr><td>7</td><td>THERMAL SHOCK TEST</td><td colspan="2">1. Thermal shock Temperature： -30℃~ 70℃
2. Temperature change rate ：25℃ / MIN
3. Dwell time low and high temperature ： 30 MIN/EACH
4. Total test cycle：10 CYCLE
5. Input/Output condition： 230VAC/Full Load AC ON/OFF TEST
turn on 58sec；turn off 2sec</td><td>OK</td></tr>
</table>

8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency： 10~500Hz (3) Sweep Time： 10min/sweep cycle (4) Acceleration： 5G (5) Test Time： 60min in each axis (X.Y.Z) (6) Ta： 25℃	TEST： OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P： FULL LOAD Ta= 25 ℃ LIFE TIME (2) I/P： 230VAC O/P： FULL LOAD Ta=50 ℃ LIFE TIME (3) I/P： 230VAC O/P： 75% LOAD Ta= 50 ℃ LIFE TIME (4) I/P： 230VAC O/P： 50% LOAD Ta= 50 ℃ LIFE TIME	(1) 396481HRS (2) 72523HRS (3) 104095HRS (4) 156612HRS
10	MTBF	MIL-HDBK-217F TOTAL FAILURE RATE： 720.6KHRS	
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50℃	

TEST RESULT	TESTER	APPROVAL
PASS	FRANK	WANGDZ

2007/3/20 A50-S014