Test Report: LRS-150F-24

150W 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

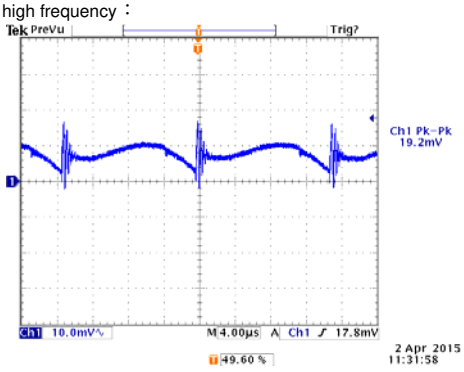
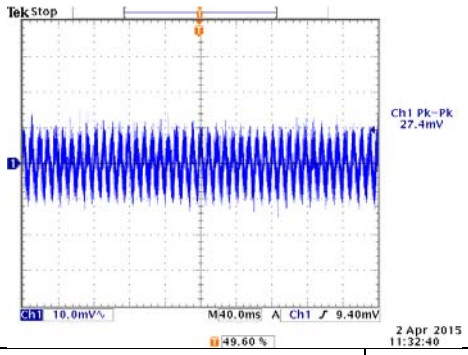
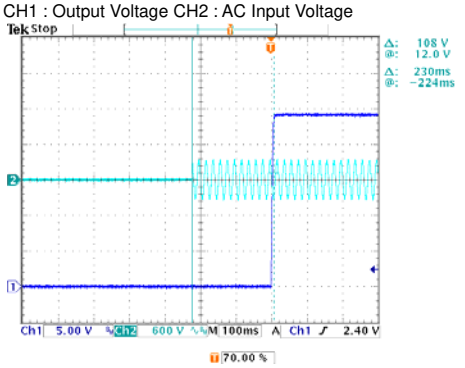
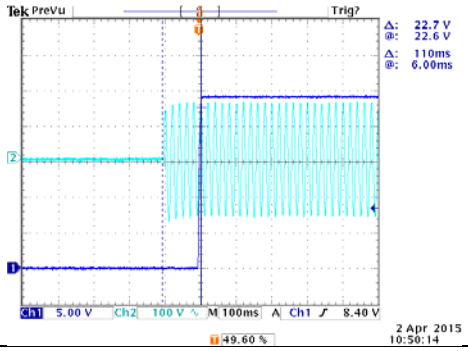
Safety Test
E.M.C. Test

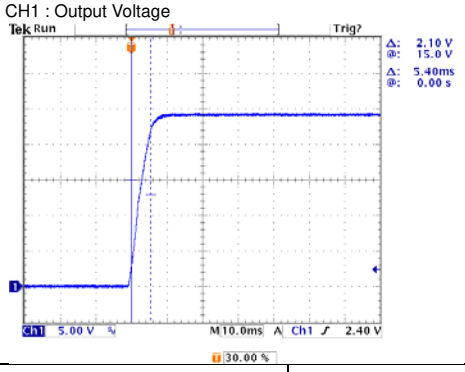
■ RELIABILITY TEST

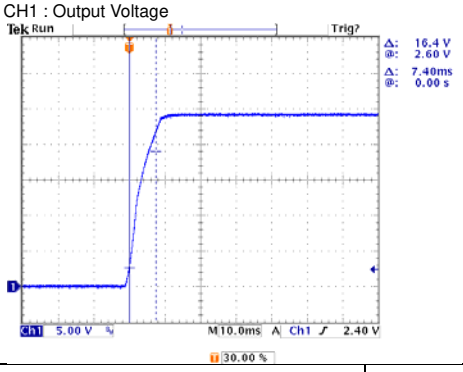
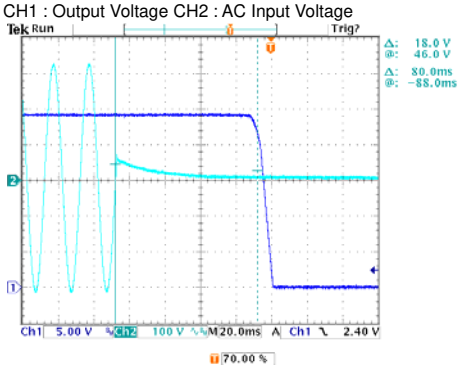
ENVIRONMENT TEST

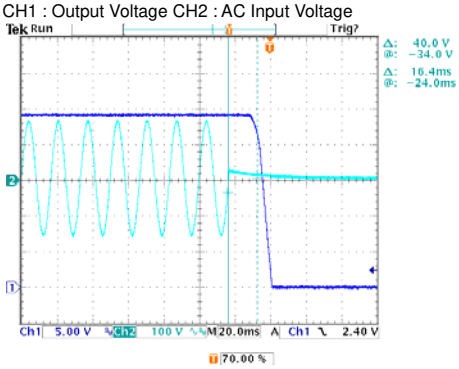
■ DESIGN VERIFY TEST

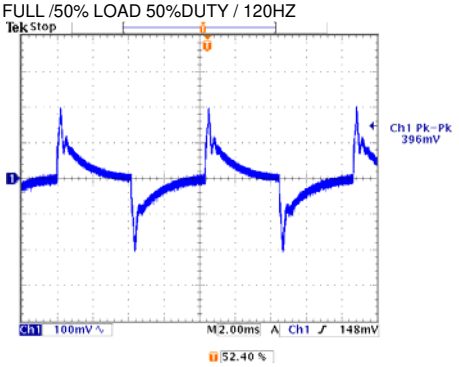
OUTPUT FUNCTION TEST

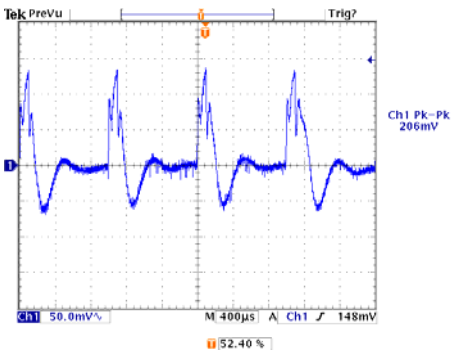
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 21.6V~ 28.8 V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	20.69V~30.53V/230VAC 20.69V~30.53V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1 %~ -1 %	I/P: 100VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: 0%~0.04%
3	LINE REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 100VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1:0 %~0.04%
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℃	V1:27.4 mVp-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/230ms 115VAC/110ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 	

<table>
<tr><td rowspan="2">8</td><td>RISE TIME (Max)</td><td>230VAC/30ms
115VAC/30ms</td><td>I/P ： 230 VAC
I/P ： 115 VAC
O/P ：FULL LOAD
Ta ：25℃</td><td>230VAC/5.4ms
115VAC/7.4ms</td></tr>
<tr><td colspan="4">INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage
 

INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage
 
</td></tr>
<tr><td rowspan="2">9</td><td>HOLD UP TIME (Typ.)</td><td>230VAC/16ms
115VAC/12ms</td><td>I/P ： 230 VAC
I/P ： 115 VAC
O/P ：FULL LOAD
Ta ：25℃</td><td>230VAC/80ms
115VAC/16.4ms</td></tr>
<tr><td colspan="4">INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage
 

INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage
 
</td></tr>
<tr><td rowspan="2">10</td><td>DYNAMIC LOAD</td><td>V1: 2400 mVp-p</td><td>I/P: 230VAC
O/P:
(1)FULL /50% LOAD 50%DUTY / 120HZ
(2)FULL /50% LOAD 50%DUTY / 1KHZ
Ta:25℃</td><td>

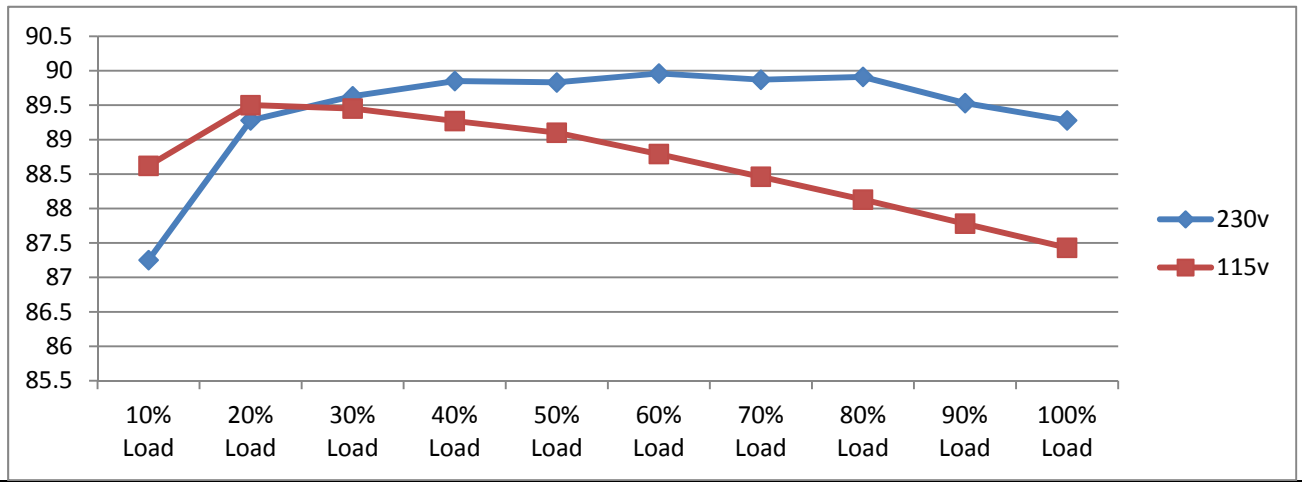
396mVp-p
206 mVp-p</td></tr>
<tr><td colspan="4">FULL /50% LOAD 50%DUTY / 120HZ
 

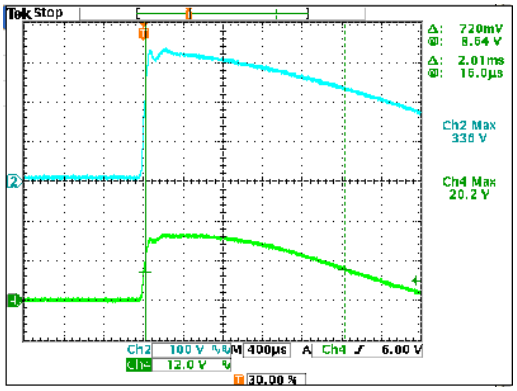
FULL /50% LOAD 50%DUTY / 1KHZ
 
</td></tr>
<tr><td>11</td><td>TRANSIENT RECOVERY TIME</td><td>V1: 2400 mVp-p
<500us</td><td>I/P: 230VAC
O/P:40% LOAD CHANGE
50%DUTY/120HZ 1.25A/us</td><td>306mVp-p
us</td></tr>
</table>

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℃	72V~264V
			I/P: (1)LOW-LINE-3V=82 V HIGH-LINE+15%=300 V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) 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:100 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 1.6A 115V/ 2.8A	I/P ： 230 VAC I/P ： 115 VAC O/P ：FULL LOAD Ta ：25℃	I =1.21A/ 230VAC I =2.43A/ 115VAC
4	LEAKAGE CURRENT	< 0.75mA / 240 VAC	I/P ： 240 VAC O/P ：Min LOAD Ta ：25℃	L-FG ： 0.530mA N-FG ： 0.530mA
5	NO LOAD CONSUMPTION	< 0.5W	I/P ：115VAC I/P ：230VAC O/P ：NO LOAD Ta ：25℃	<0.2601 W < 0.3566W
6	EFFICIENCY(Typ.)	89%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	89.17%

EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	230V/60A COLD START	I/P ： 230 VAC O/P ：FULL LOAD Ta ：25℃	I =20.2A/ 230VAC T50=2010us/230V
	INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current (1V=1A) 			

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	110%~ 140 %	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P:TESTING Ta:25℃	124.6%/ 264VAC 124.9%/ 230VAC 122.6%/100VAC PROTECTION TYPE： Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	28.8V~33.6V	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P:MIN LOAD Ta:25℃	32.15V/ 264VAC 32.2V/ 230VAC 32.15V/ 85VAC PROTECTION TYPE： Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 264VAC I/P:85VAC O/P:FULL LOAD	O.T.P. Active PROTECTION TYPE： Shut down o/p voltage, re-power on to recover
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P:85VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE PROTECTION TYPE： Hiccup mode, recovers automatically after fault condition is removed

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q1 Rated :13A/600V	I/P:High-Line +3V =267V AC ON/OFF VDS: O/P: (1)Full Load (2)Output Short (3) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz	 VDS: (1) 574V (2) 532V (3) 588V (4) 536V

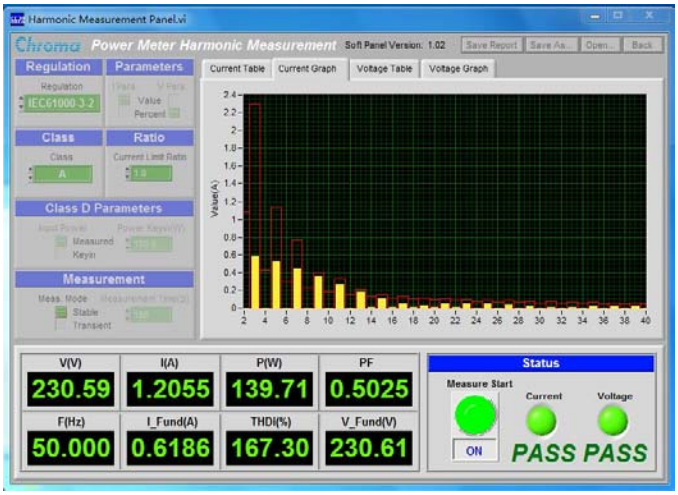
			(4) 0%→400% Load. I/P:Low-Line -3V = 97V O/P: (1)Full Load (2)Output Short (3) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (4) 0%→400% Load. Ta:25℃	VDS: (1) 346V (2) 268V (3) 358V (4) 267V
2	Diode Peak **Voltage**	Q101 Rated :20 A/150 V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (4) 0%→400% Load. (5).NO LOAD Ta:25℃	Q101: VDS: (1) 143V (2) 135V (3) 142V (4) 142V (5) 135V
3	**Input Capacitor Voltage**	C5 Rated: : 120 μ/400 V 105 ℃	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) 368V
4	**Control IC Voltage Test**	PWM IC U1 Rated : 28V 10.5V(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 下限.LOW LINE Ta:25℃	1. 21.6V 2. 13.3V 3. 20.6V 4. 25.8V 5. 16.7V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 4KVAC/min I/P-FG :2KVAC/min O/P-FG:1.25KVAC/min	I/P-O/P: 4.4 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.5 KVAC/min Ta:25℃	I/P-O/P: 3.24mA I/P-FG: 3.88mA O/P-FG: 3.25m 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:9999 MΩ O/P-FG:9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	28mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT

1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:80%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-150F-12
1. ROOM AMBIENT BURN-IN：2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=27.2℃
2. HIGH AMBIENT BURN-IN： 2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=40.6℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 27.2 ℃</th><th>HIGH AMBIENT Ta=40.6 ℃</th></tr>
<tr><td>1</td><td>D6</td><td>66.2℃</td><td>77.9℃</td></tr>
<tr><td>2</td><td>C6</td><td>67.4℃</td><td>76.7℃</td></tr>
<tr><td>3</td><td>Q1</td><td>84.7℃</td><td>96.6℃</td></tr>
<tr><td>4</td><td>C35</td><td>66.3℃</td><td>76.3℃</td></tr>
<tr><td>5</td><td>BD1</td><td>86.4℃</td><td>95.7℃</td></tr>
<tr><td>6</td><td>Q100</td><td>96.9℃</td><td>107.0℃</td></tr>
<tr><td>7</td><td>C106</td><td>77.9℃</td><td>89.5℃</td></tr>
<tr><td>8</td><td>LF1</td><td>65.6℃</td><td>76.5℃</td></tr>
<tr><td>9</td><td>RTH10</td><td>75.4℃</td><td>86.7℃</td></tr>
<tr><td>10</td><td>R14</td><td>73.7℃</td><td>86.1℃</td></tr>
<tr><td>11</td><td>T1</td><td>82.4℃</td><td>92.4℃</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：113% 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 40 ℃
NO DAMAGE</td><td>I/P： 272 VAC
O/P：FULL LOAD
Ta= 45 ℃
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>
</table>

7	THERMAL SHOCK TEST	1. Thermal shock Temperature： -20℃~ 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	OK
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=45 ℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 45 ℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 45 ℃ LIFE TIME	(1) 81305HRS (2) 33047HRS (3) 48975HRS (4) 93362HRS
10	MTBF	MIL-HDBK-217F TOTAL FAILURE RATE：648.6KHRS	
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