Test Report: LRS-150-15

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

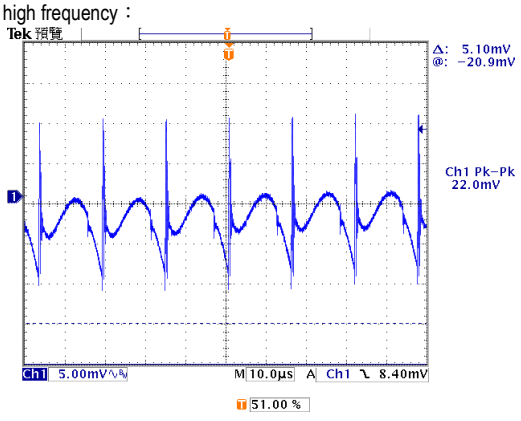
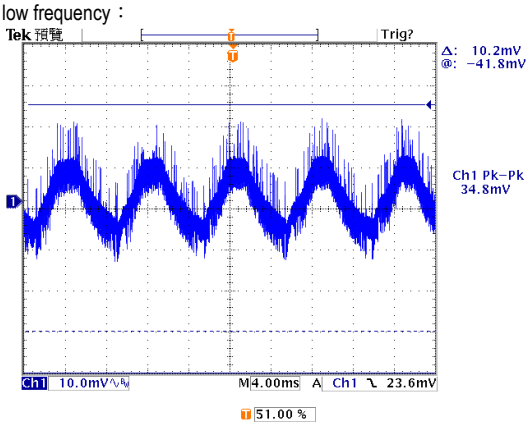
Safety Test
E.M.C. Test

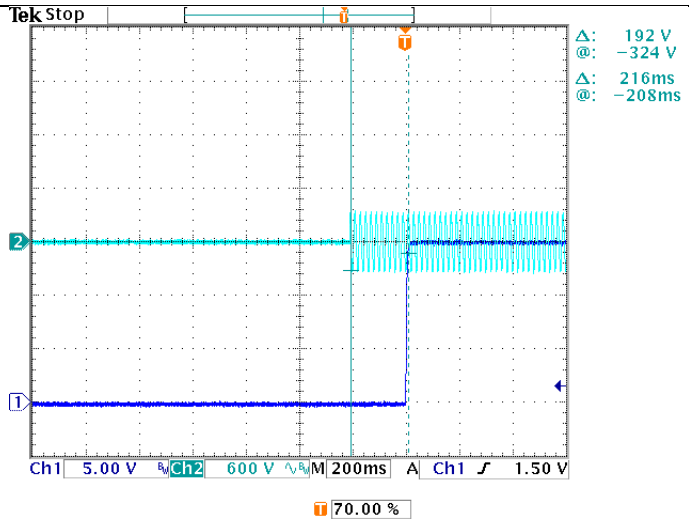
■ RELIABILITY TEST

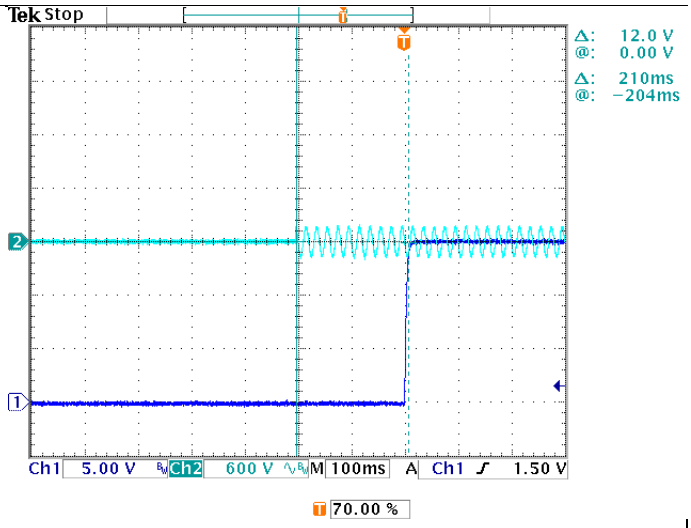
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 13.5 V~ 18 V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	12.80V~18.50V/230VAC 12.80V~18.50V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1 %~ -1 %	I/P: 100~132VAC/200~264VAC by switch O/P:FULL/ MIN. LOAD Ta:25℃	V1: 0%~-0.066%
3	LINE REGULATION (Max)	V1: 0.5 %~ -0.5 %	I/P: 100~132VAC/200~264VAC by switch O/P:FULL LOAD Ta:25℃	V1: 0%~--0.066%
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: 150 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 34.8mVp-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/216 ms 115VAC/210 ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	

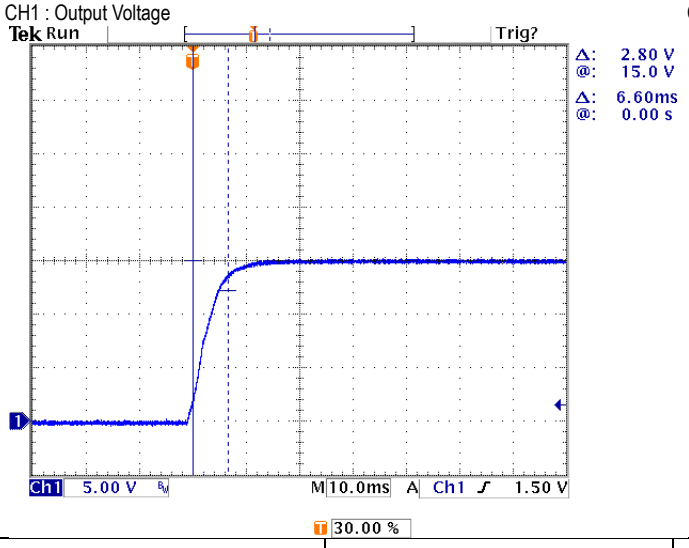




8	RISE TIME (Max)	230VAC/30ms 115VAC/30ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 6.6ms 115VAC/6.2ms

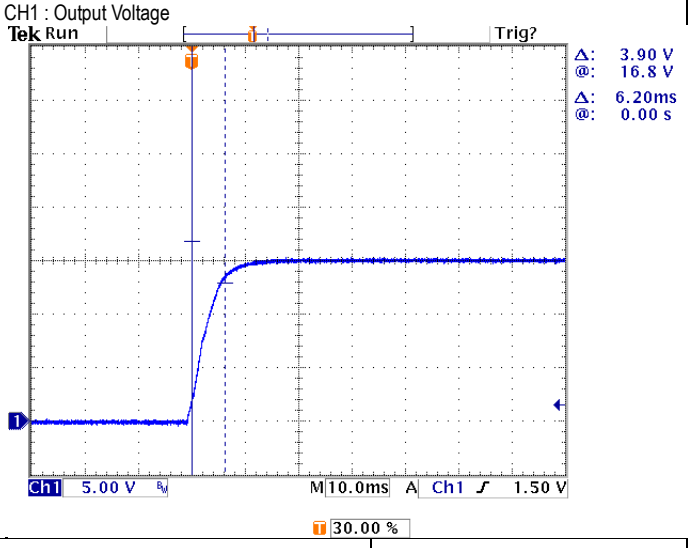
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage



INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage



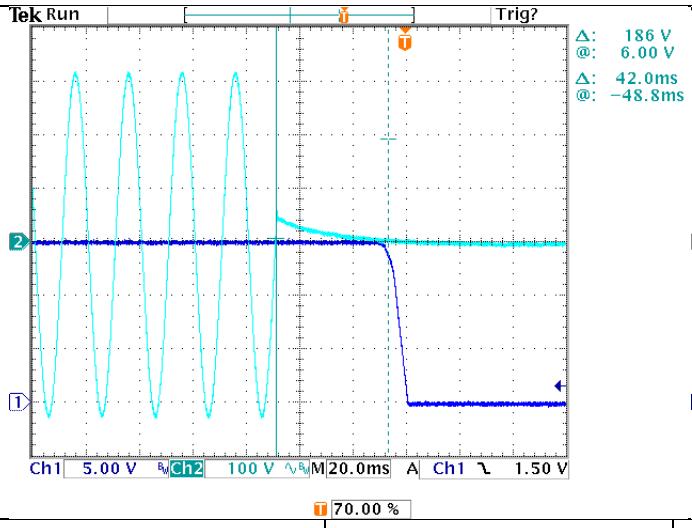
9	HOLD UP TIME (Typ.)	230VAC/40ms 115VAC/35ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 42ms 115VAC/ 37.4ms

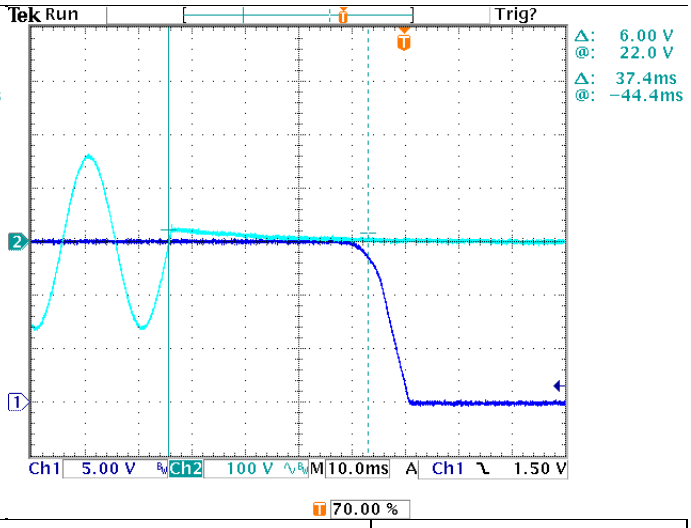
INPUT=230VAC/50HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

INPUT=115VAC/60HZ @ FULL LOAD

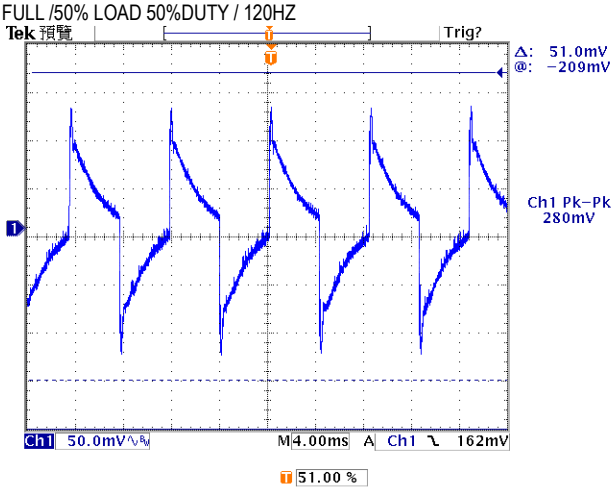
CH1 : Output Voltage CH2 : AC Input Voltage



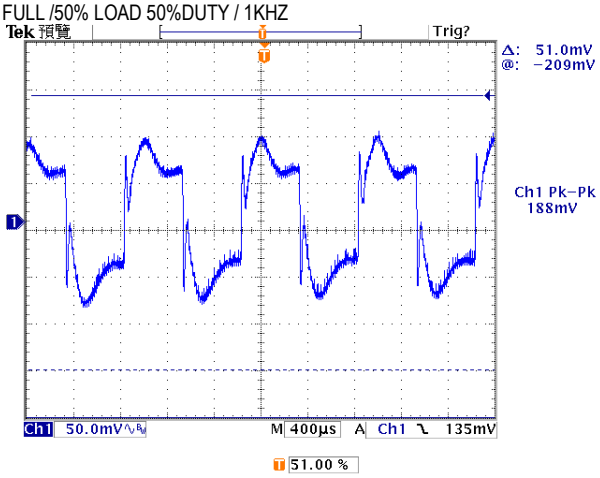


10	DYNAMIC LOAD	V1: 1500 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	 280mVp-p 188mVp-p

FULL /50% LOAD 50%DUTY / 120HZ



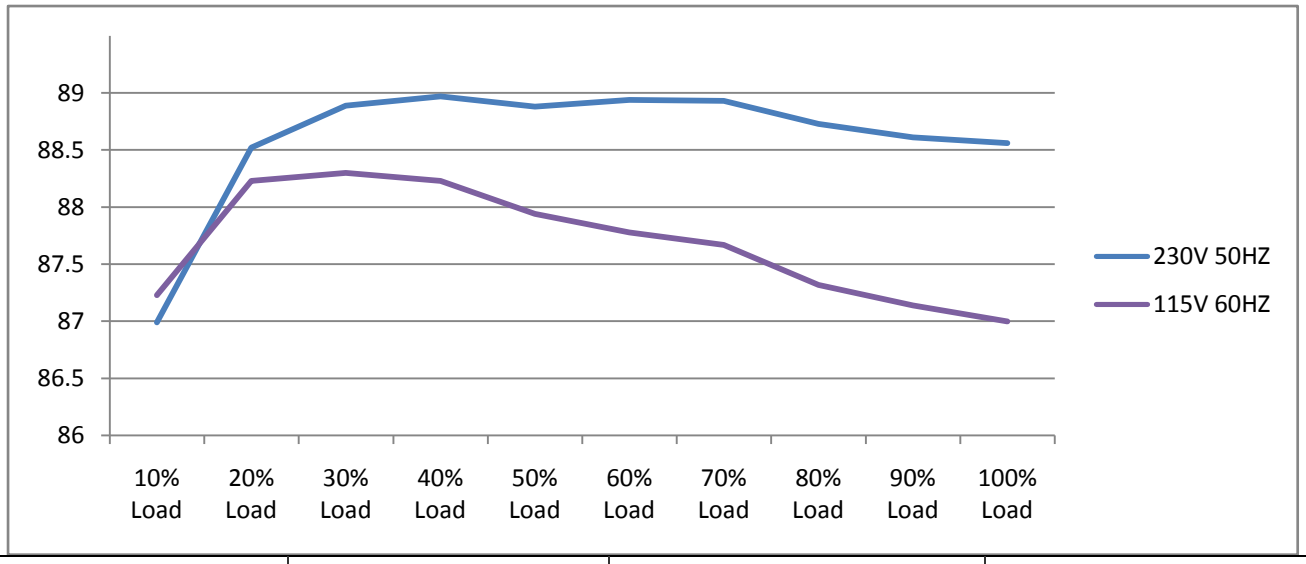
FULL /50% LOAD 50%DUTY / 1KHZ



11	TRANSIENT RECOVERY TIME	V1: 1500 mVp-p <500us	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	233mVp-p 0 us

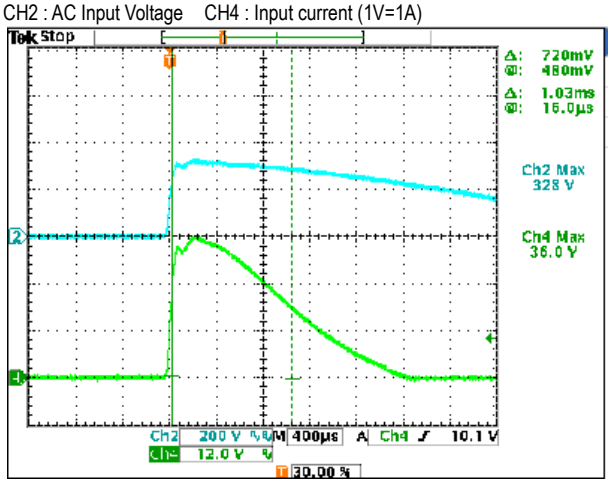
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85~132VAC/170~264VAC by switch	I/P:TESTING O/P:FULL LOAD Ta:25℃	69V~132V 130V~264V
			I/P: (1)LOW-LINE-3V=87V 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/ 2.8 A	I/P ： 230 VAC I/P ： 115 VAC O/P ：FULL LOAD Ta ：25℃	I =1.17A/ 230VAC I =2.45A/ 115VAC
4	LEAKAGE CURRENT	< 0.75mA / 240 VAC	I/P ： 240 VAC O/P ：Min LOAD Ta ：25℃	L-FG ： 0.516mA N-FG ： 0.516mA
5	NO LOAD CONSUMPTION	< 0.5 W	I/P ：115VAC I/P ：230VAC O/P ：NO LOAD Ta ：25℃	< 0.2759W < 0.3753W
6	EFFICIENCY(Typ.)	88.5%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	88.57%
	EFFICIENCY vs LOAD			
7	INRUSH CURRENT(Typ.)	230V/60A COLD START	I/P ： 230 VAC O/P ：FULL LOAD Ta ：25℃	I =36A/ 230VAC



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℃	122.4%/ 264VAC 122.9%/ 230VAC 125.4%/100VAC PROTECTION TYPE： Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	18.75 V~ 21.75 V	I/P: 264VAC I/P: 230VAC I/P: 90VAC O/P:MIN LOAD Ta:25℃	20.34V/ 264VAC 20.31V/ 230VAC 20.36V/ 85VAC PROTECTION TYPE： Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 264VAC I/P: 90VAC 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: 90VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE PROTECTION TYPE： Hiccup mode, recovers automatically after fault condition is removed

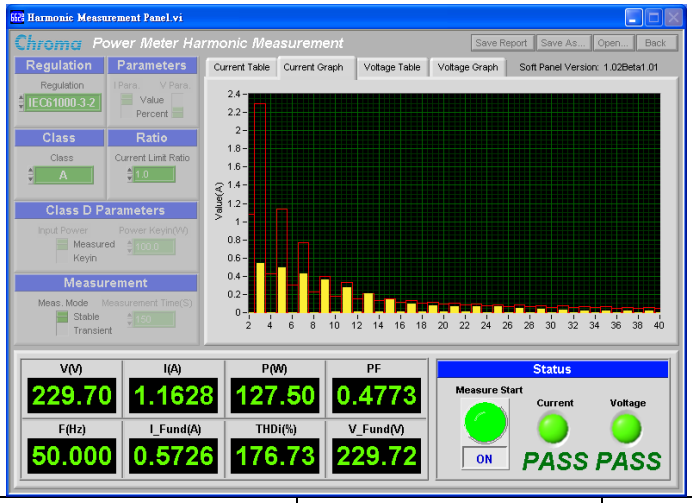
COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) **Peak Voltage**	Q 1 Rated :13 A/600V VGS :± 25 V	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 (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) 578V (2) 502V (3) 564V (4) 588V VDS: (1) 466V (2) 406V (3) 466V (4) 492V
4	Diode Peak **Voltage**	Q101 Rated : 20 A/100V	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) 96.8V (2) 89.6V (3) 94.8V (4) 98.0V (5) 92.0V
5	**Input Capacitor Voltage**	C5 Rated: : 330 μ/200 V 105 ℃ Suger Voltage=230V	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) 180V (2)181 V (3) 182V
6	**Control IC Voltage Test**	PWM IC U1 Rated NCP1236B: 28 V(MAX.) 10.5 V(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. 20.0V 2. 12.2V 3. 18.2V 4. 24.7V 5. 15.5V

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: 3.42mA I/P-FG: 4.70mA O/P-FG: 3.21m 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℃	27mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P: 75% 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-150-24
1. ROOM AMBIENT BURN-IN：2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=25.5℃
2. HIGH AMBIENT BURN-IN： 2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=45.3℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 25.5 ℃</th><th>HIGH AMBIENT Ta=45.3 ℃</th></tr>
<tr><td>1</td><td>D5</td><td>87.8℃</td><td>100.6℃</td></tr>
<tr><td>2</td><td>C35</td><td>63.3℃</td><td>79.4℃</td></tr>
<tr><td>3</td><td>Q1</td><td>80.9℃</td><td>99.3℃</td></tr>
<tr><td>4</td><td>BD1</td><td>72.3℃</td><td>88.2℃</td></tr>
<tr><td>5</td><td>Q100</td><td>86.3℃</td><td>105.3℃</td></tr>
<tr><td>6</td><td>C106</td><td>68.5℃</td><td>85.9℃</td></tr>
<tr><td>7</td><td>LF1</td><td>60.3℃</td><td>77.0℃</td></tr>
<tr><td>8</td><td>RTH10</td><td>60.5℃</td><td>76.5℃</td></tr>
<tr><td>9</td><td>R14</td><td>79.2℃</td><td>95.1℃</td></tr>
<tr><td>10</td><td>T1</td><td>82.2℃</td><td>97.8℃</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：120% 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
O/P：100 % LOAD
I/P： 100VAC
O/P：75% 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%/℃(0~50℃)</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>
<tr><td>8</td><td>VIBRATION TEST</td><td colspan="2">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℃</td><td>TEST：OK</td></tr>
</table>

9	CAPACITOR LIFE CYCLE	SUPPOSE C106 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) 146770HRS (2) 30596HRS (3) 54079HRS (4) 92239HRS
10	MTBF	MIL-HDBK-217F TOTAL FAILURE RATE：601KHRS	
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