



# Test Report: RS-15-12

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15W 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

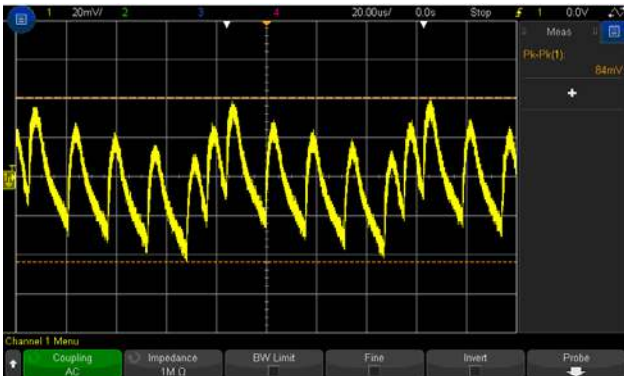
ENVIRONMENT TEST

DESIGN VERIFY TEST

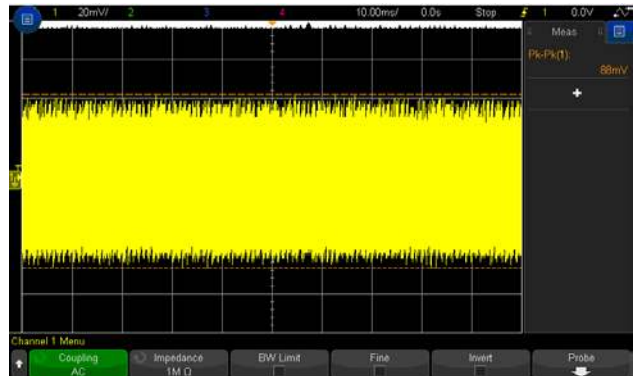
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 10.8V~13.2V	I/P : 230 VAC O/P : MIN LOAD Ta : 25°C	9.27V~13.7V
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.0%~1.0%	I/P: 85VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1 : -0.05%~0.05%
3	LINE REGULATION (Max)	V1: -0.5%~0.5%	I/P: 85VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1 : -0.02%~0.02%
4	LOAD REGULATION(Max)	V1: -0.5%~0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1 : -0.05%~0.05%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	2.5%
6	RIPPLE & NOISE(Max )	V1: 120mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 88mVp-p

high frequency (V1) :



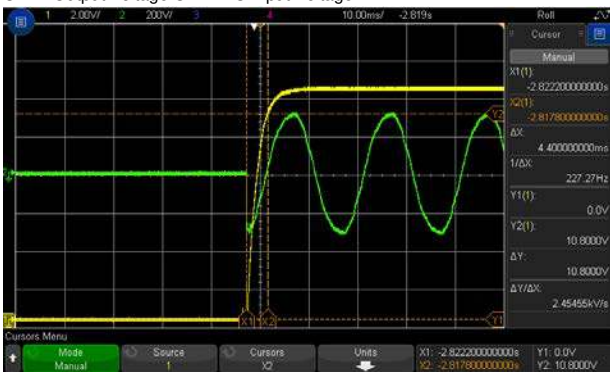
low frequency (V1) :



7	SET UP TIME(Max)	230VAC/1000ms 115VAC/1000ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/4.4ms 115VAC/ 7.2ms
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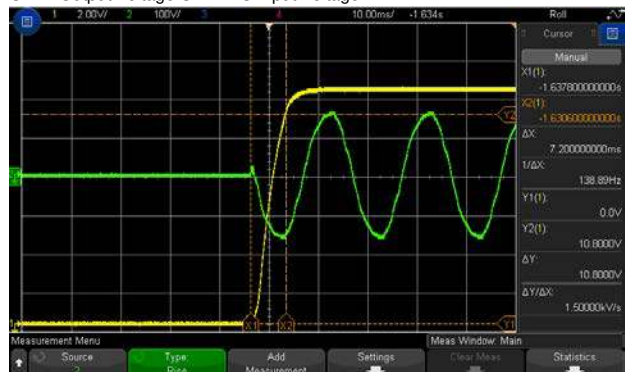
INPUT=230VAC/50HZ @ FULL LOAD

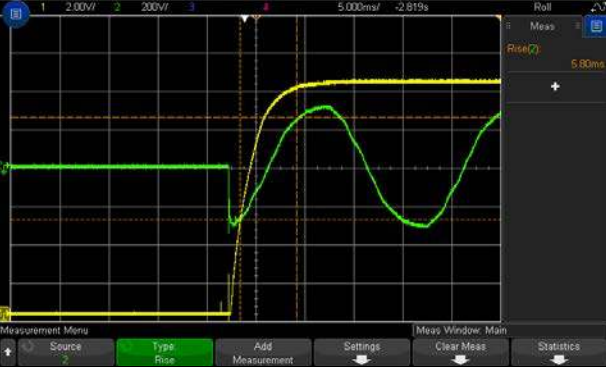
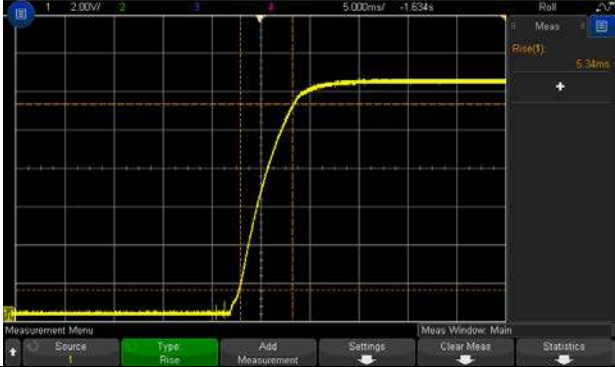
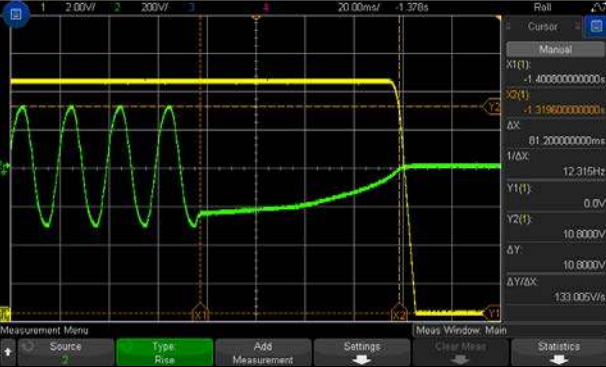
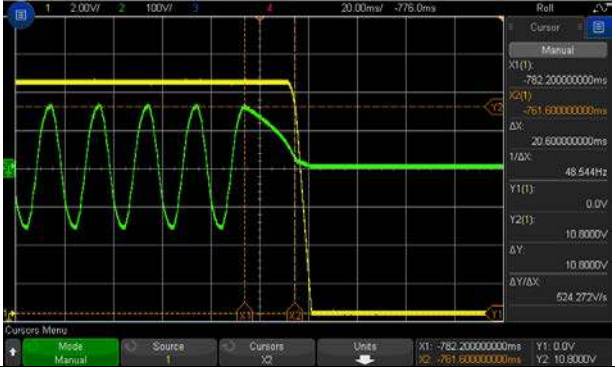
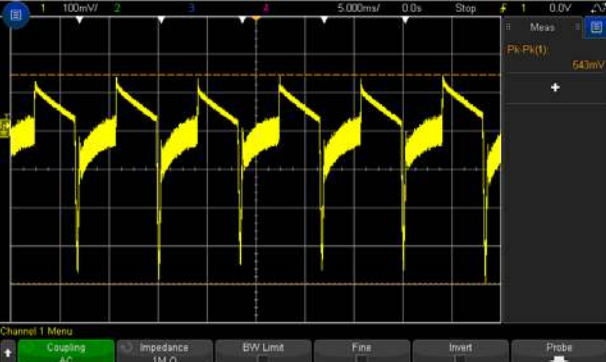
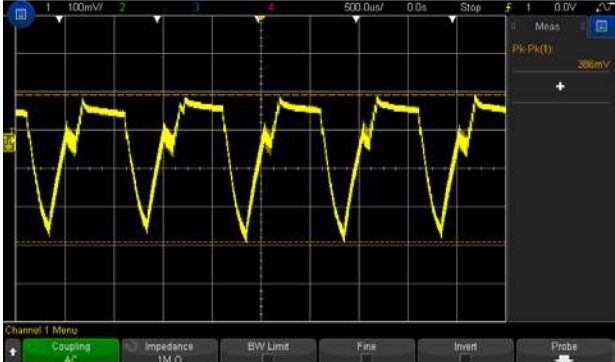
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage

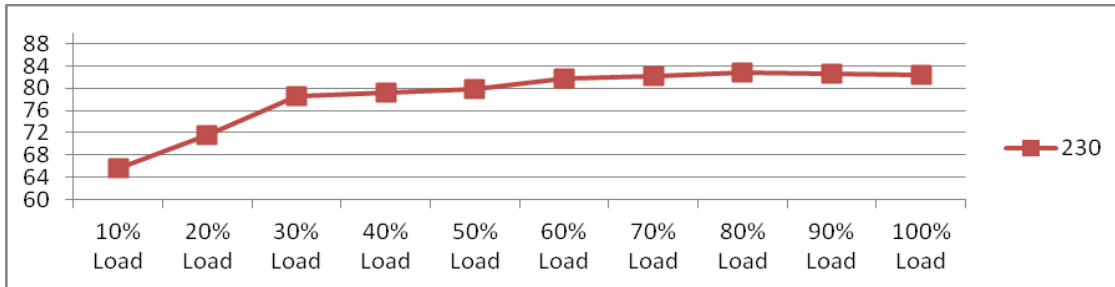


<p>8</p> <p>RISE TIME (Max)</p>	<p>230VAC/30ms 115VAC/30ms</p>	<p>I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C</p>	<p>230VAC/5.8ms 115VAC/5.3ms</p>
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage</p> 		<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage</p> 	
<p>9</p> <p>HOLD UP TIME (Typ.)</p>	<p>230VAC/70ms 115VAC/12ms</p>	<p>I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C</p>	<p>230VAC/81.2ms 115VAC/20.6ms</p>
<p>INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> 		<p>INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage</p> 	
<p>10</p> <p>DYNAMIC LOAD</p>	<p>V1: 1200 mVp-p</p>	<p>I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C</p>	<p>(1) (2) V1: 543mVp-p 386mVp-p</p>
<p>FULL /50% LOAD 50%DUTY / 120HZ ( V1 )</p> 		<p>FULL /50% LOAD 50%DUTY / 1KHZ ( V1 )</p> 	

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC~264VAC 120VDC~370VDC	I/P:TESTING O/P:FULL LOAD Ta:25°C	67V~264V
			I/P: 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 (POWER ON/OFF NO DAMAGE)	TEST:OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P:85 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK
3	INPUT CURRENT (Typ.)	230V/ 0.25A 115V/0.35A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =0.16A/ 230VAC I = 0.26A/ 115VAC
4	LEAKAGE CURRENT	<2mA	I/P : 240VAC O/P : Min LOAD Ta : 25°C	0.16mA
5	NO LOAD POWER CONSUMPTION	< 0.5W	I/P : 230 VAC O/P : Min LOAD Ta : 25°C	0.30W
6	EFFICIENCY(Typ.)	81%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	82.3%

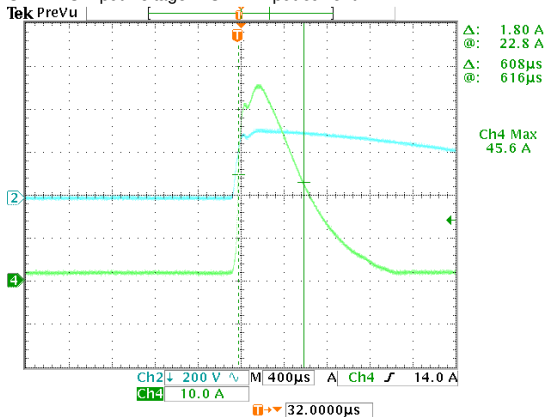
EFFICIENCY vs LOAD



7	INRUSH CURRENT(Typ.)	230V / 65A COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I = 45.6A/ 230VAC
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INPUT=230VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	>105%	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P: TESTING Ta:25°C	176%/ 264VAC 153%/ 230VAC 127%/100VAC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	13.8V~16.2V	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD Ta:25°C	15.7V/ 264VAC 15.8V/ 230VAC 15.7V/ 85VAC PROTECTION TYPE : Shut down o/p voltage, repower on to recover
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 85VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
4	OVER TEMPERATURE PROTECTION	Protection type : Shut down	I/P: 264VAC I/P: 90VAC O/P: FULL LOAD	O.T.P. Active PROTECTION TYPE : Shut down o/p voltage, recovers automatically after temperature goes down

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor ( D to S) or (C to E) Peak Voltage	U1 Rated : 700 V	AC ON/OFF I/P: High-Line +3V =267V VDS: O/P: (1) Full Load (2) Output Short (3) Full Load Continue Ta:25°C	VDS: (1) 630V (2) 638V (3) 626V
2	O/P Diode	D100 Rated : 100 V	AC ON/OFF I/P: High-Line +3V =267 V O/P: (1) Full Load (2) Output Short (3) Full Load Continue Ta:25°C	VDS: (1) 85.0V (2) 70.5V (3) 80.2V
3	Input Capacitor Voltage	C5 Rated :33 μ / 400 V	I/P: High-Line +3V =267V O/P: (1) Full Load input on/off (2) Min load input on /Off (3) Full Load /Min load Change (4) Full load continue Ta:25°C	(1) 397V (2) 373V (3) 369V (4) 369 V
4	Clamp Diode	D1 Rated :1000 V	AC ON/OFF I/P : High-Line +3V = 267 V O/P : (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (4) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25°C	(1) 616V (2) 532V (3) 616V (4) 616V

**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG:2 KVAC/min O/P-FG: 0.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P- FG: 2.4 KVAC/min O/P - FG: 0.6 KVAC/min Ta:25°C	I/P-O/P:1.53mA I/P-FG:0.81mA O/P-FG:0.64mA 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: 600 VDC I/P- FG: 600 VDC Ta:25°C	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	40 A / 2min Ta: 25°C/70%RH	8 mΩ

**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°C	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL
2	CONDUCTION	EN55032 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN55032 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 <input checked="" type="checkbox"/> LIGHT INDUSTRY AIR: 8KV / Contact: 4KV <input type="checkbox"/> INDUSTRY AIR: 8KV / Contact: 4KV <input type="checkbox"/> Din rail Model : AIR: 15KV / Contact: 8KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 <input checked="" type="checkbox"/> LIGHT INDUSTRY INPUT : 1KV <input type="checkbox"/> MEDICAL <input type="checkbox"/> INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 <input type="checkbox"/> LIGHT INDUSTRY L-N : 1KV L/N-PE : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report.			

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																												
1	TEMPERATURE RISE TEST	MODEL : RS-15-5 1. ROOM AMBIENT BURN-IN : 1.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 23 °C 2. HIGH AMBIENT BURN-IN : 1.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 50.2 °C																																														
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 23 °C</th> <th>HIGH AMBIENT Ta= 50.2 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>57.3°C</td><td>83.1°C</td></tr> <tr><td>2</td><td>T1</td><td>87.4°C</td><td>105.9°C</td></tr> <tr><td>3</td><td>D100</td><td>99.7°C</td><td>98.6°C</td></tr> <tr><td>4</td><td>L100</td><td>65.5°C</td><td>87.3°C</td></tr> <tr><td>5</td><td>U1</td><td>107.0°C</td><td>113.7°C</td></tr> <tr><td>6</td><td>C5</td><td>51.3°C</td><td>76.1°C</td></tr> <tr><td>7</td><td>C105</td><td>72.8°C</td><td>90.1°C</td></tr> <tr><td>8</td><td>BD1</td><td>55.0°C</td><td>79.7°C</td></tr> <tr><td>9</td><td>D1</td><td>63.0°C</td><td>85.7°C</td></tr> <tr><td>10</td><td>ZD1</td><td>62.7°C</td><td>85.7°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 23 °C	HIGH AMBIENT Ta= 50.2 °C	1	LF1	57.3°C	83.1°C	2	T1	87.4°C	105.9°C	3	D100	99.7°C	98.6°C	4	L100	65.5°C	87.3°C	5	U1	107.0°C	113.7°C	6	C5	51.3°C	76.1°C	7	C105	72.8°C	90.1°C	8	BD1	55.0°C	79.7°C	9	D1	63.0°C	85.7°C	10	ZD1	62.7°C	85.7°C		
NO	Position	ROOM AMBIENT Ta= 23 °C	HIGH AMBIENT Ta= 50.2 °C																																													
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4	L100	65.5°C	87.3°C																																													
5	U1	107.0°C	113.7°C																																													
6	C5	51.3°C	76.1°C																																													
7	C105	72.8°C	90.1°C																																													
8	BD1	55.0°C	79.7°C																																													
9	D1	63.0°C	85.7°C																																													
10	ZD1	62.7°C	85.7°C																																													
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 137% LOAD Ta : 25°C	TEST : OK																																												
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC O/P : 100 % LOAD Ta= -25 °C	TEST : OK																																												
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50°C /95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK																																												
5	TEMPERATURE COEFFICIENT	± 0.03%/°C (0~50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.0017 %/°C (0~50°C)																																												
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : STATIC		TEST : OK																																												
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -25°C~ +55°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 16 CYCLE 5. Input/Output condition : 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test		TEST : 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 : 180min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta=50 °C LIFE TIME	(1) 79411.7 HRS (2) 27882.3 HRS (3) 58704.4 HRS (4) 77052.2 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 1608.8K hrs min. MIL-HDBK-217F (25°C)	
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure : 30,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		Wangdz

2018.4.30 GP-A50-F010