



# Test Report: LRS-150-48

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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

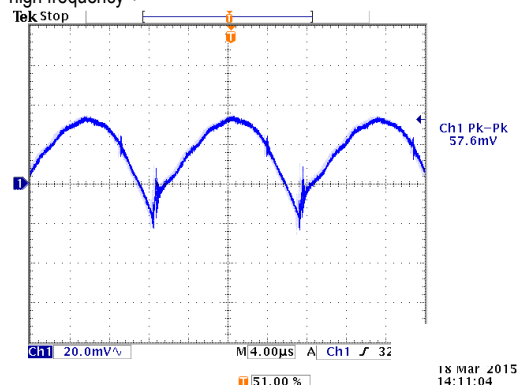
ENVIRONMENT TEST

# DESIGN VERIFY TEST

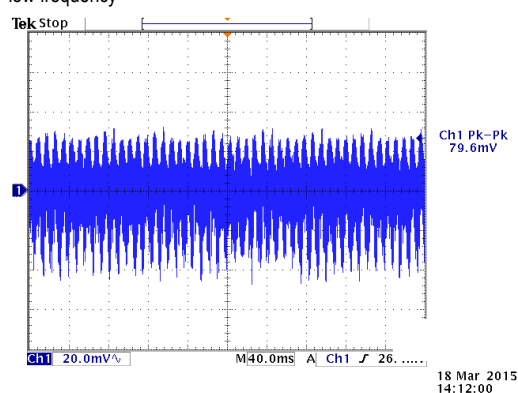
## OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 43.2V~52.8V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	41.42V~55.23V/230VAC 41.42V~55.23V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: 1%~-1%	I/P: 100~132VAC/200~264VAC by switch O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.02%~0%
3	LINE REGULATION (Max)	V1: 0.5%~-0.5%	I/P: 100~132VAC/200~264VAC by switch O/P:FULL LOAD Ta:25°C	V1:-0.02%~0%
4	LOAD REGULATION(Max)	V1: 0.5%~-0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0%~ 0%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	<0.5%
6	RIPPLE & NOISE(Max)	V1: 200 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 79.6 mVp-p

high frequency :



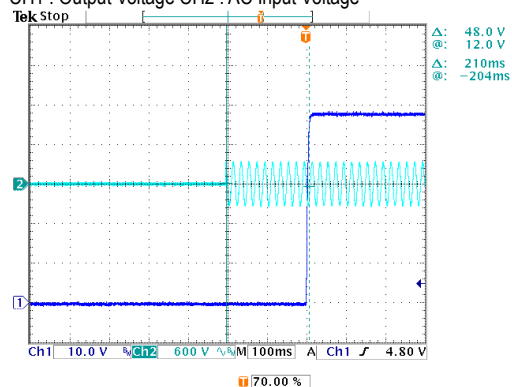
low frequency :



7	SET UP TIME(Max)	230VAC/500ms 115VAC/500ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/210 ms 115VAC/ 220ms
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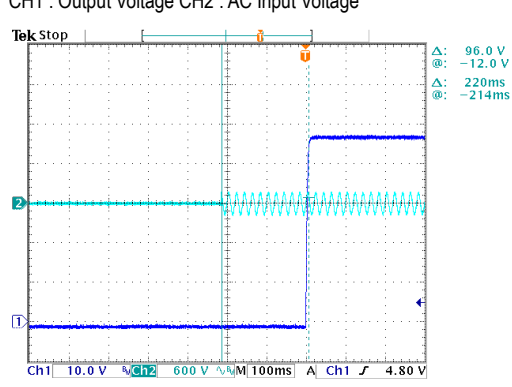
INPUT=230VAC/50HZ @ FULL LOAD

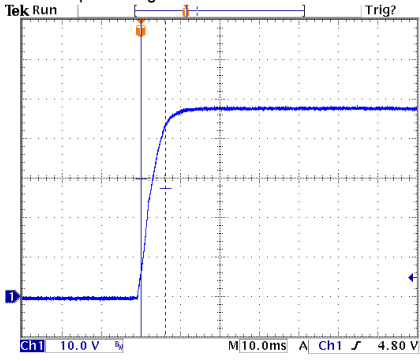
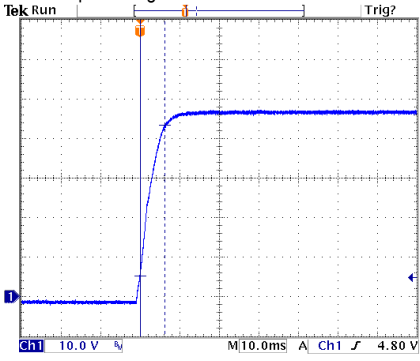
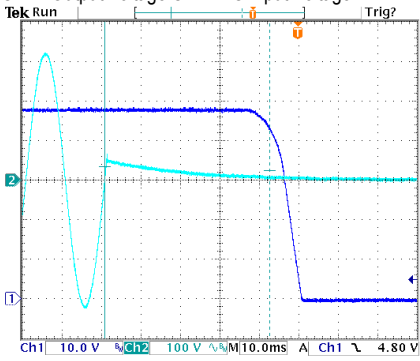
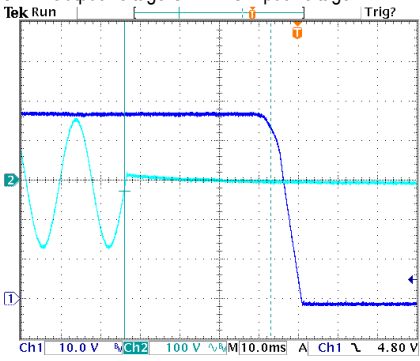
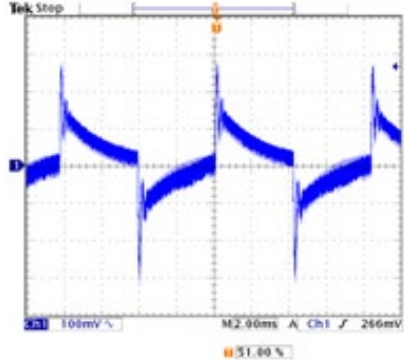
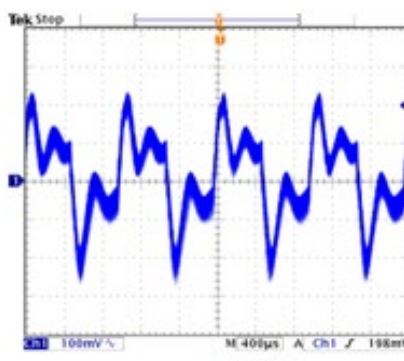
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

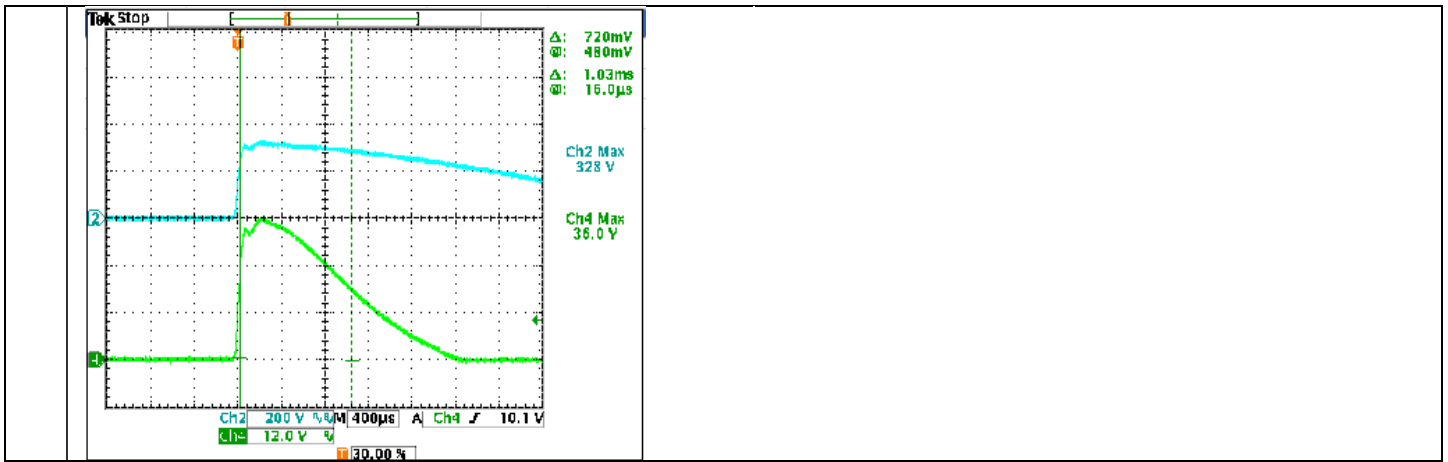
CH1 : Output Voltage CH2 : AC Input Voltage



8	RISE TIME (Max)	230VAC/30ms 115VAC/30ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 6.2ms 115VAC/6.2 ms
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°C	230VAC/41.8 ms 115VAC/ 37ms
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: 4800 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	546mVp-p 494mVp-p
FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 		
11	TRANSIENT RECOVERY TIME	V1: 4800 mVp-p <500us	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	600mVp-p 120us

## NPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																	
1	INPUT VOLTAGE RANGE	85~132VAC/170~264VAC by switch  240 ~ 370VDC (switch on 230VAC)	I/P:TESTING O/P:FULL LOAD Ta:25°C	76V~132V 130V~264V 230 ~ 370VDC (switch on 230VAC)																																	
			I/P: (1)LOW-LINE-3V=82V 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:170 VAC ~264 VAC O/P:FULL-MIN LOAD Ta:25°C	TEST: OK																																	
3	INPUT CURRENT (Typ.)	230V/ 1.7A 115V/ 3.0 A	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I =1.24A/ 230VAC I =2.41A/ 115VAC																																	
4	LEAKAGE CURRENT	< 0.75mA / 240 VAC	I/P : 240 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.410mA N-FG : 0.410mA																																	
5	NO LOAD CONSUMPTION	< 0.5 W	I/P : 115VAC I/P : 230VAC O/P : NO LOAD Ta : 25°C	< 0.1851W < 0.2778W																																	
6	EFFICIENCY(Typ.)	90 %	I/P:230 VAC O/P:FULL LOAD Ta:25°C	90.50%																																	
<p>EFFICIENCY vs LOAD</p> <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>Load (%)</th> <th>230V Efficiency (%)</th> <th>115V Efficiency (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>88.3</td><td>88.5</td></tr> <tr><td>20%</td><td>90.1</td><td>89.8</td></tr> <tr><td>30%</td><td>90.5</td><td>89.8</td></tr> <tr><td>40%</td><td>90.4</td><td>89.5</td></tr> <tr><td>50%</td><td>90.8</td><td>89.8</td></tr> <tr><td>60%</td><td>90.8</td><td>89.6</td></tr> <tr><td>70%</td><td>90.7</td><td>89.5</td></tr> <tr><td>80%</td><td>90.8</td><td>89.4</td></tr> <tr><td>90%</td><td>90.5</td><td>89.1</td></tr> <tr><td>100%</td><td>90.5</td><td>88.9</td></tr> </tbody> </table>					Load (%)	230V Efficiency (%)	115V Efficiency (%)	10%	88.3	88.5	20%	90.1	89.8	30%	90.5	89.8	40%	90.4	89.5	50%	90.8	89.8	60%	90.8	89.6	70%	90.7	89.5	80%	90.8	89.4	90%	90.5	89.1	100%	90.5	88.9
Load (%)	230V Efficiency (%)	115V Efficiency (%)																																			
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50%	90.8	89.8																																			
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70%	90.7	89.5																																			
80%	90.8	89.4																																			
90%	90.5	89.1																																			
100%	90.5	88.9																																			
7	INRUSH CURRENT(Typ.)	230V/60A COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I =36A/ 230VAC T50=1030 us/230V																																	
<p>INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current (1V=1A)</p>																																					



### 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°C	120.3%/ 264VAC 123.03%/ 230VAC 122.4%/100VAC PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	55.2 V~ 64.8 V	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD Ta:25°C	62.98V/ 264VAC 62.98V/ 230VAC 63.05V/ 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°C	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 :13A/600 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°C	VDS: (1) 522V (2) 460V (3) 548V (4) 544V  VDS: (1) 402V (2) 330V (3) 434V (4) 446V
4	Diode Peak Voltage	Q101 Rated : 20A/300 V	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3) Dynamic Load 100% Load/	Q101: VDS: (1) 294V (2) 246V (3) 272V

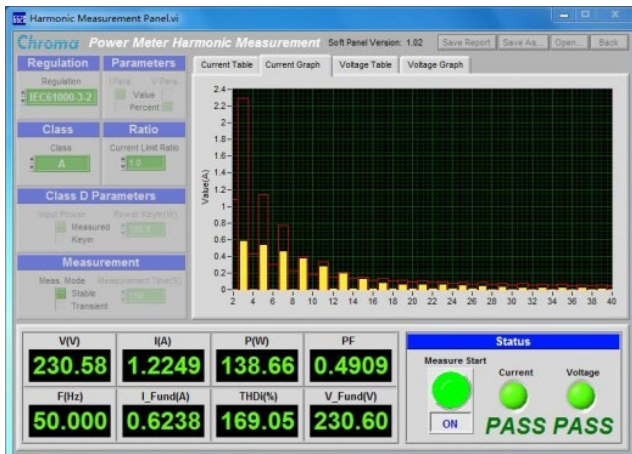
			Min. Load 50%Duty/120Hz (4) 0%→400% Load. (5).NO LOAD Ta:25°C	(4) 288V (5) 284V
5	Input Capacitor Voltage	C5 Rated: : 330 $\mu$ /200 V 105 °C	I/P:High-Line +3V =267 V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change Ta:25°C	(1) 182V (2) 183V (3) 182V
6	Control IC Voltage Test	PWM IC U1 Rated : 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°C	(1) 20.7V (2) 12.2V (3) 12.3V (4) 25.1V (5) 16.5V

### 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°C	I/P-O/P: 3.423mA I/P-FG: 4.55mA O/P-FG: 3.27m A NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M $\Omega$ I/P-FG: 500VDC>100M $\Omega$ O/P-FG:500VDC>100M $\Omega$	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P:9999M $\Omega$ I/P-FG: 9999M $\Omega$ O/P-FG:9999M $\Omega$ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 m $\Omega$	40A / 2min Ta:25°C	28m $\Omega$

### 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°C	PASS



2	CONDUCTION	EN55022 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN55022 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 INDUSTRY AIR : 8KV / Contact : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	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°C	CRITERIA A
7	Test by certified Lab & Test Report Prepare			

## RELIABILITY TEST

### ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																
1	TEMPERATURE RISE TEST	MODEL : LRS-150-24 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=25.5°C 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta=45.3°C																																																		
				<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 25.5 °C</th> <th>HIGH AMBIENT Ta=45.3 °C</th> </tr> </thead> <tbody> <tr> <td>1</td> <td><b>D5</b></td> <td>87.8°C</td> <td>100.6°C</td> </tr> <tr> <td>2</td> <td><b>C35</b></td> <td>63.3°C</td> <td>79.4°C</td> </tr> <tr> <td>3</td> <td><b>Q1</b></td> <td>80.9°C</td> <td>99.3°C</td> </tr> <tr> <td>4</td> <td><b>BD1</b></td> <td>72.3°C</td> <td>88.2°C</td> </tr> <tr> <td>5</td> <td><b>Q100</b></td> <td>86.3°C</td> <td>105.3°C</td> </tr> <tr> <td>6</td> <td><b>C106</b></td> <td>68.5°C</td> <td>85.9°C</td> </tr> <tr> <td>7</td> <td><b>LF1</b></td> <td>60.3°C</td> <td>77.0°C</td> </tr> <tr> <td>8</td> <td><b>RTH10</b></td> <td>60.5°C</td> <td>76.5°C</td> </tr> <tr> <td>9</td> <td><b>R14</b></td> <td>79.2°C</td> <td>95.1°C</td> </tr> <tr> <td>10</td> <td><b>T1</b></td> <td>82.2°C</td> <td>97.8°C</td> </tr> <tr> <td>11</td> <td><b>TA</b></td> <td>25.5°C</td> <td>45.3°C</td> </tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 25.5 °C	HIGH AMBIENT Ta=45.3 °C	1	<b>D5</b>	87.8°C	100.6°C	2	<b>C35</b>	63.3°C	79.4°C	3	<b>Q1</b>	80.9°C	99.3°C	4	<b>BD1</b>	72.3°C	88.2°C	5	<b>Q100</b>	86.3°C	105.3°C	6	<b>C106</b>	68.5°C	85.9°C	7	<b>LF1</b>	60.3°C	77.0°C	8	<b>RTH10</b>	60.5°C	76.5°C	9	<b>R14</b>	79.2°C	95.1°C	10	<b>T1</b>	82.2°C	97.8°C	11	<b>TA</b>	25.5°C	45.3°C
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10	<b>T1</b>	82.2°C	97.8°C																																																	
11	<b>TA</b>	25.5°C	45.3°C																																																	
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230 VAC O/P : 120% 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 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	±0.006%/°C (0~50°C)
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -40°C ~ +85°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 5 CYCLE 5. Input/Output condition : STATIC		OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -30°C ~ 70°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 : 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°C		TEST : OK
9	CAPACITOR LIFE CYCLE	SUPPOSE C106 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) 146770HRS (2) 30596HRS (3) 54079HRS (4) 92239HRS
10	MTBF	2707.7K hrs min. Telcordia SR-332 (Bellcore) ; 558.2Khrs min. MIL-HDBK-217F (25°C)		
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50°C		

TEST RESULT	TESTER	APPROVAL
PASS	FRANK	WANGDZ

2007/3/20 A50-S014