Test Report: LRS-200-24

200W Single Output Switching Power Supply

■ DESIGN VERIFY TEST

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

■ SAFETY TEST

■ RELIABILITY TEST

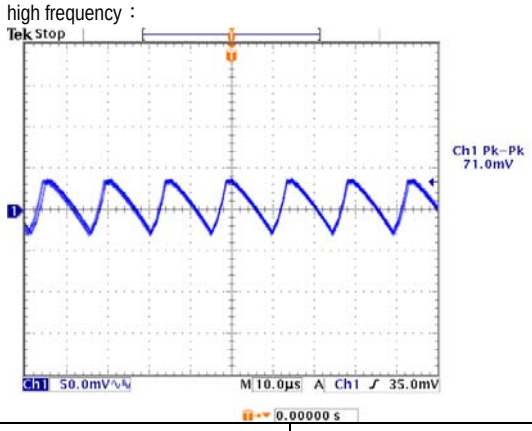
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

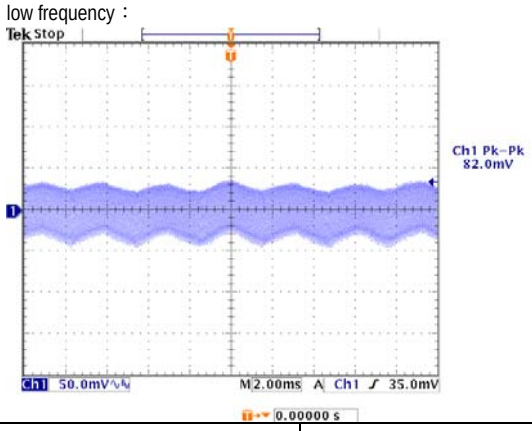
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 21.6~ 28.8V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	21.329V~30.081V/230VAC 21.274V~30.073V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.5 %~ 1.5%	I/P: 100VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1:- 0.04%~ 0.04%
3	LINE REGULATION (Max)	V1: -0.5 %~ 0.5 %	I/P: 100VAC~ 264VAC O/P:FULL LOAD Ta:25℃	V1: -0. 02%~-0.02%
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	< ±10%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	<5%
6	RIPPLE & NOISE(Max)	V1: 150mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 82.0mVp-p

high frequency：



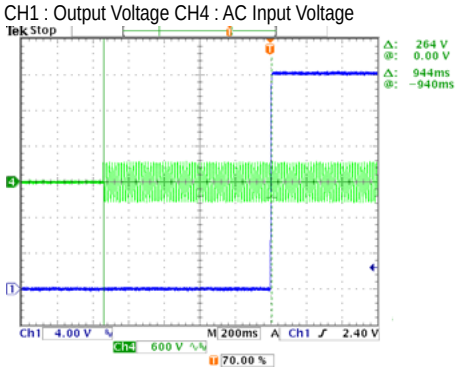
low frequency：



7	SET UP TIME(Max)	230VAC/1300ms 115VAC/ 1300ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 944ms 115VAC/ 1042ms

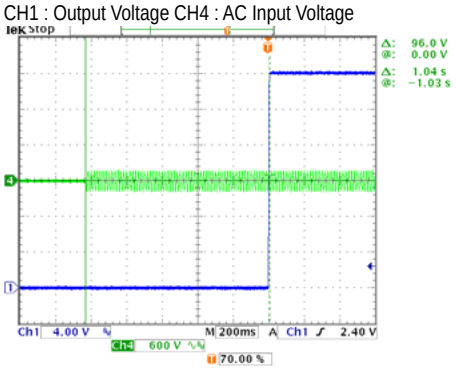
INPUT=230VAC/50HZ @ FULL LOAD

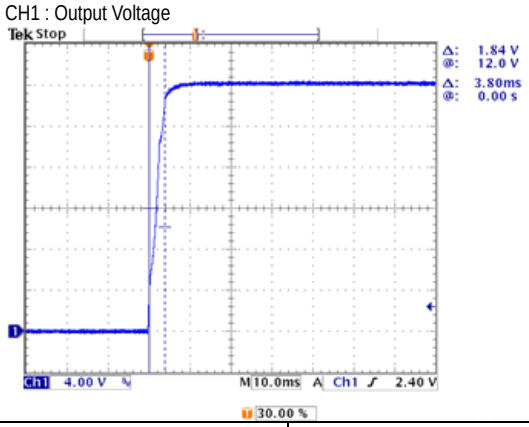
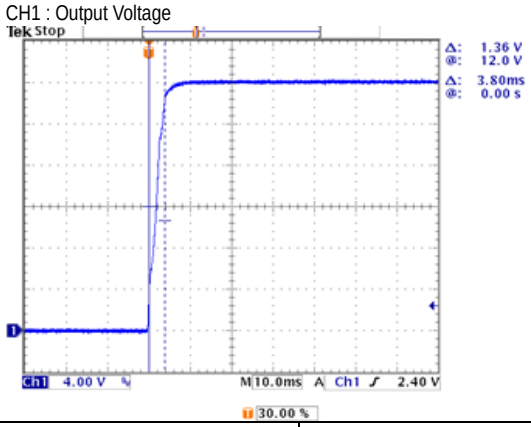
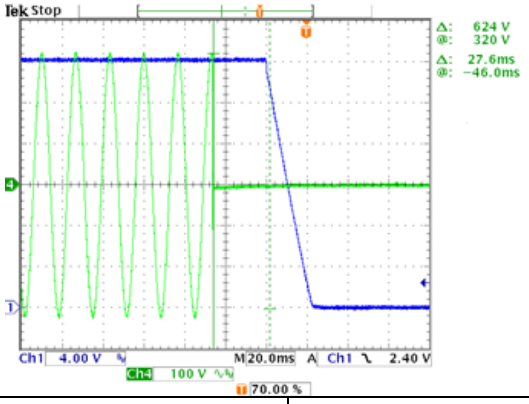
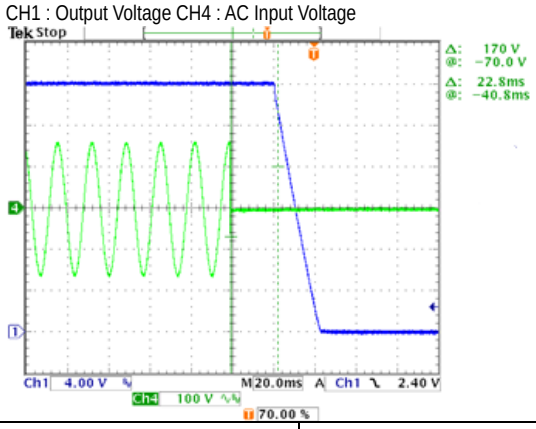
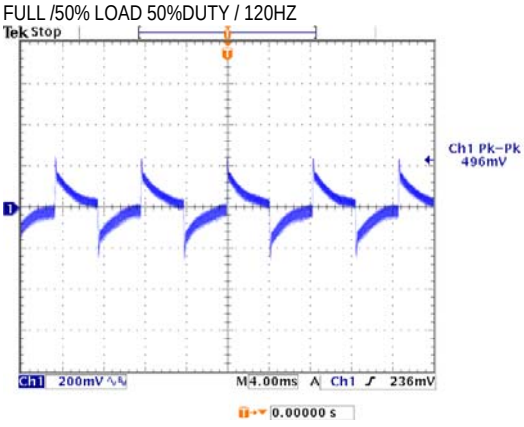
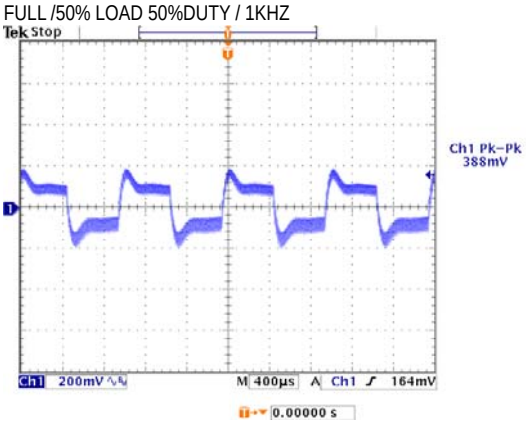
CH1 : Output Voltage CH4 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH4 : AC Input Voltage



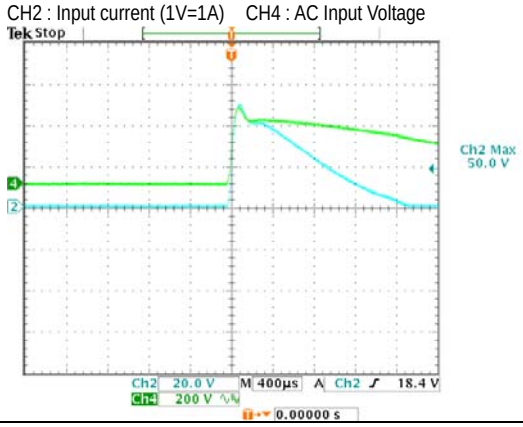
8	RISE TIME (Max)	230VAC/ 50ms 115VAC/ 50ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 3.80ms 115VAC/3.80ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
9	HOLD UP TIME(Typ)	230VAC/ 16ms 115VAC/ 12ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 27.6ms 115VAC/ 22.8ms
	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: 1200 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	 496mVp-p 388mVp-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	180VAC~264VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	136V~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/ 2.2.A 115V/ 4A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =2.03A/ 230VAC I =3.74A/ 115VAC
4	LEAKAGE CURRENT	< 2 mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	L-FG：0.460 mA N-FG：0.460 mA
5	NO LOAD CONSUMPTION	< 0.75 W	I/P：115VAC I/P：230VAC O/P：NO LOAD Ta：25℃	< 0.57W < 0.52 W
6	INRUSH CURRENT(Typ)	230V/ 60A 115V/ 60A COLD START	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =50.0A/ 230VAC I =47.2A/ 115VAC

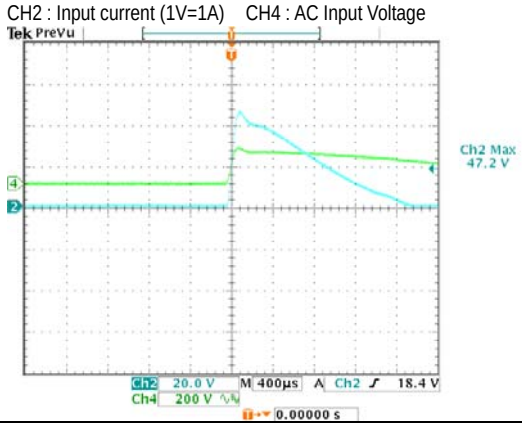
INPUT=230VAC/50HZ @ FULL LOAD

CH2 : Input current (1V=1A) CH4 : AC Input Voltage



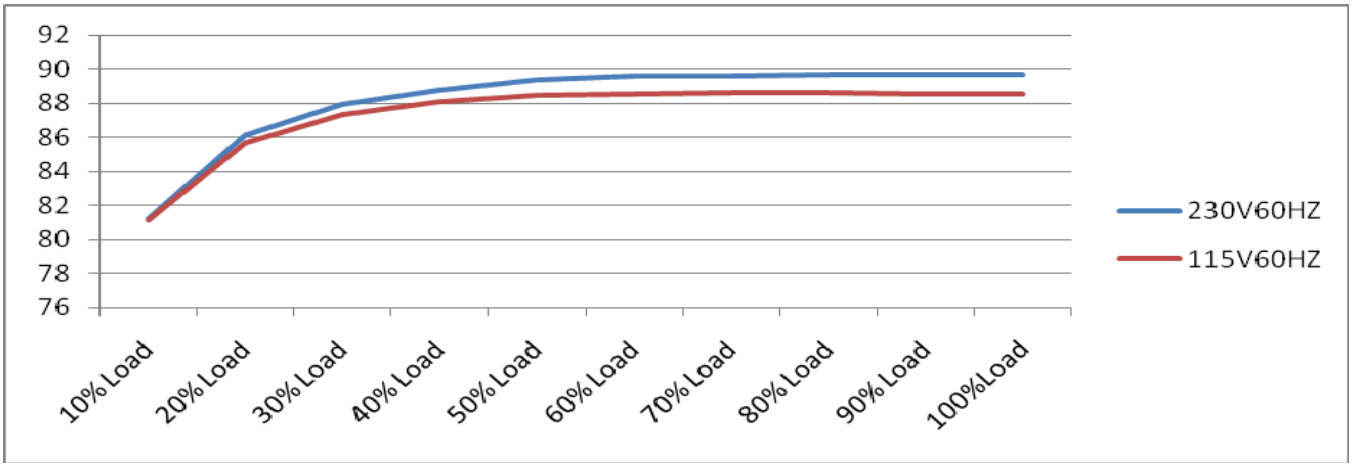
INPUT=115VAC/50HZ @ FULL LOAD

CH2 : Input current (1V=1A) CH4 : AC Input Voltage



7	EFFICIENCY(Typ)	89.5%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	89.61%

EFFICIENCY vs LOAD



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	110 %~ 140 %	I/P: 230VAC I/P: 115VAC O/P:TESTING Ta:25℃	128.63%/ 230VAC 127.61%/115VAC Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	CH: 28.8 V~ 33.6 V	30.7V/ 230VAC 31.8V/115VAC O/P:MIN LOAD Ta:25℃	Hiccup mode, recovers automatically after fault condition is removed
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 230 VAC O/P:FULL LOAD	O.T.P. Active Hiccup mode, recovers automatically after fault condition is removed
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE 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	I/P:High-Line +3V =267V O/P： (1)Full Load Turn on (2)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (3)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25℃	(1)436V (2)440V (3)440V
2	Diode Peak **Voltage**	Q102 Rated 20 A/150V Q103 Rated 20A/200V	I/P:High-Line +3V =267 V O/P: (1)Full Load input on/off (2)Output Short Ta:25℃	Q102: (1)118V (2)122V Q103: (1)170V (2)160V
3	**Input Capacitor Voltage**	C5 Rated: 330 μ / 200V	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)186V (3)181V
4	**Control IC Voltage Test**	PWM IC U1 Rated 28 V (MAX.) 10V (MIN.)	I/P:High-Line +3V =267 V O/P: (1)Full Load input on/off (2) Output short (3)No load VR（min） Ta:25℃	U1 (1) 20.5V (2) 20.3V (3) 20.5V

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/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℃	I/P-O/P: 2.431mA I/P-FG: 3.34mA O/P-FG:2.72 m 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℃	22mΩ

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-200-24
1. ROOM AMBIENT BURN-IN：2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=24.6℃
2. HIGH AMBIENT BURN-IN： 2 HRS
I/P： 230VAC O/P： FULL LOAD Ta=48.4℃
<table><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta= 24.6 ℃</th><th>HIGH AMBIENT Ta=48.4 ℃</th></tr><tr><td>1</td><td>U1</td><td>58.3℃</td><td>79.7℃</td></tr><tr><td>2</td><td>LF1</td><td>50.5℃</td><td>73.3℃</td></tr><tr><td>3</td><td>BD1</td><td>54.0℃</td><td>75.8℃</td></tr><tr><td>4</td><td>C36</td><td>62.8℃</td><td>86.5℃</td></tr><tr><td>5</td><td>C5</td><td>59.3℃</td><td>80.1℃</td></tr><tr><td>6</td><td>C6</td><td>60.1℃</td><td>80.6℃</td></tr><tr><td>7</td><td>T2</td><td>59.2℃</td><td>81.1℃</td></tr><tr><td>8</td><td>Q1</td><td>64.5℃</td><td>88.4℃</td></tr><tr><td>9</td><td>Q2</td><td>60.4℃</td><td>83.9℃</td></tr><tr><td>10</td><td>T1coil</td><td>85.4℃</td><td>108.6℃</td></tr><tr><td>11</td><td>RTH3</td><td>79.2℃</td><td>102.2℃</td></tr><tr><td>12</td><td>L100</td><td>84.3℃</td><td>108.8℃</td></tr><tr><td>13</td><td>C106</td><td>49.5℃</td><td>73.9℃</td></tr><tr><td>14</td><td>Q102</td><td>68.0℃</td><td>89.7℃</td></tr><tr><td>15</td><td>Q103</td><td>71.7℃</td><td>93.7℃</td></tr><tr><td>16</td><td>C201</td><td>56.7℃</td><td>80.2℃</td></tr><tr><td>17</td><td>C200</td><td>64.6℃</td><td>88.1℃</td></tr><tr><td>18</td><td>L101</td><td>65.9℃</td><td>88.5℃</td></tr><tr><td>19</td><td>RTH1</td><td>86.7℃</td><td>106.9℃</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：125％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= -25 ℃</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>±0.005%/℃(0~50℃)</td></tr>
<tr><td>6</td><td>STORAGE TEMPERATURE TEST</td><td colspan="2">1. Thermal shock Temperature： -45℃~ +90℃
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： -25℃~ 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 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) 553675HRS (2) 93919HRS (3) 138388HRS (4) 183951HRS
10	MTBF	MIL-HDBK-217F TOTAL FAILURE RATE：347.5KHRS	
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