Test Report: LSP-160-3.3

160W Slim Type with PFC Switching Power Supply

■ DESIGN VERIFY TEST

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

■ SAFETY & E.M.C. TEST

Safety Test
E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

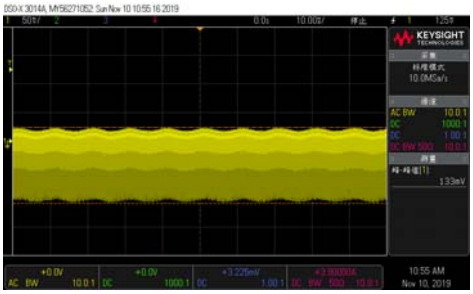
■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	3.2V ~ 3.5V	I/P： 230 VAC O/P：MIN LOAD Ta：25℃	3.03V~3.64V/230VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	-2% ~ 2%	I/P: 100VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	-0.19%~ +0.65%
3	LINE REGULATION (Max)	-0.5% ~ 0.5%	I/P: 100VAC~ 264VAC O/P:FULL LOAD Ta:25℃	-0%~ +0.012%
4	LOAD REGULATION(Max)	-1% ~ 1%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	-0.399%~ +0.43%
5	OVER/UNDERSHOOT TEST	<±15%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	3.5%
6	RIPPLE & NOISE(Max)	200mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 133mVp-p/100%LOAD

high frequency：

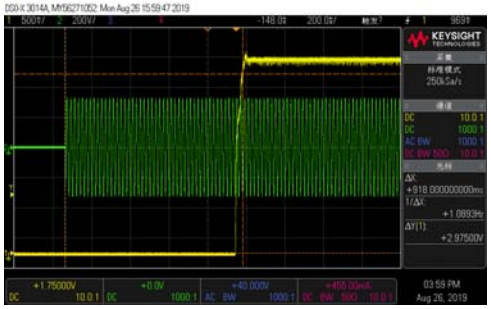
low frequency：



7	SET UP TIME(Max)	230VAC/2000ms 115VAC/3000ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/918ms 115VAC/1058ms

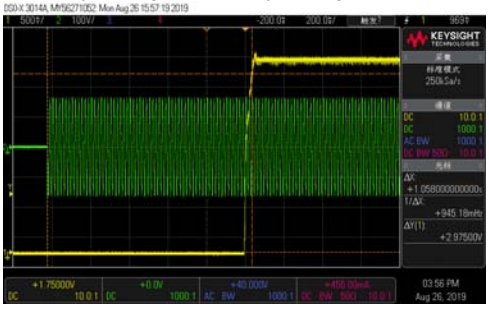
INPUT=230VAC/50HZ @ FULL LOAD

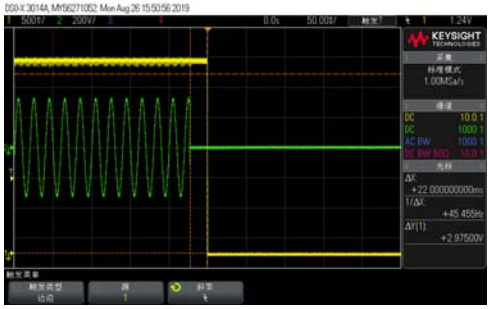
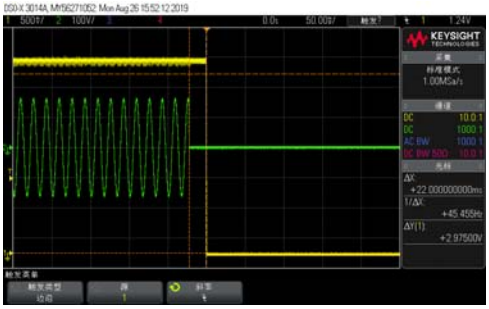
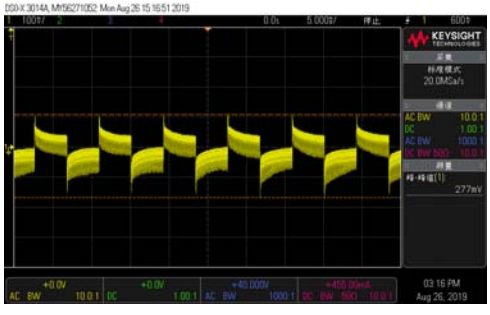
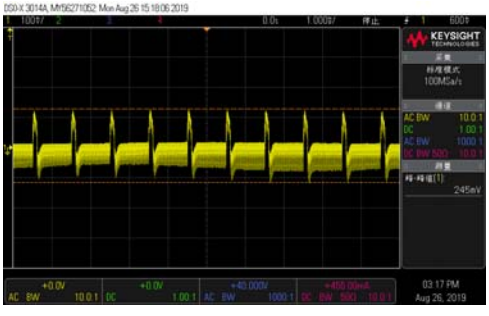
CH1 : Output Voltage CH2 : AC Input Voltage



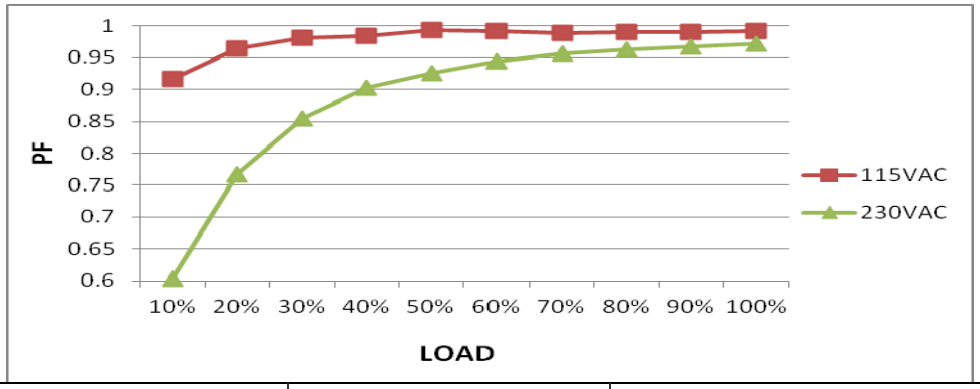
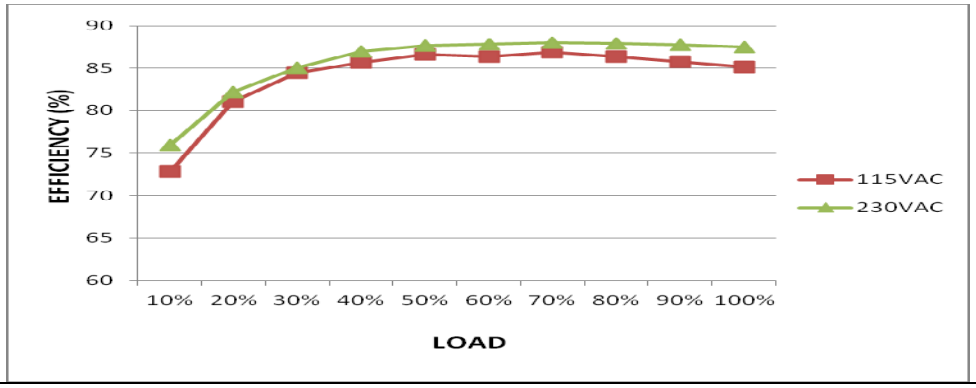
INPUT=115VAC/60HZ @ FULL LOAD

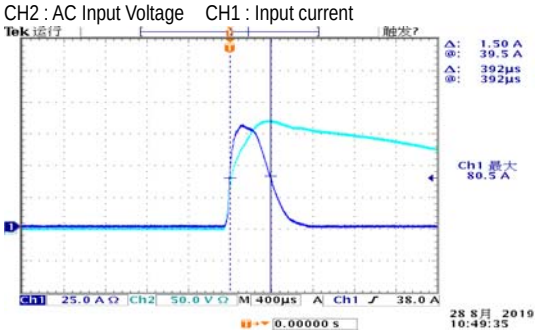
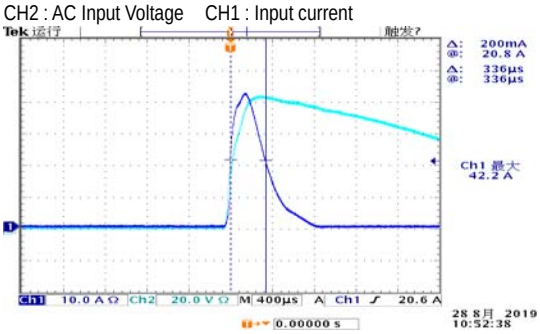
CH1 : Output Voltage CH2 : AC Input Voltage



8	RISE TIME (Max)	230VAC/80ms 115VAC/80ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 36ms 115VAC/ 38ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage 		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage 	
9	HOLD UP TIME (Typ.)	230VAC/10ms 115VAC/10ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/22ms 115VAC/ 22ms
	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	990mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ	(1) 277mVp-p (2) 245mVp-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	100VAC~264VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	97V~300V
			I/P: LOW-LINE-3V=97VAC HIGH-LINE+15%=300VAC 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:100VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK
3	INPUT CURRENT (Typ.)	230VAC/ 1.1A 115VAC/ 2.2A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =0.54A/ 230VAC I =1.06A/ 115VAC
4	LEAKAGE CURRENT	<0.75 mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	L-FG： 0.536mA N-FG： 0.537mA
5	POWER FACTOR (Typ.)	0.94/ 230VAC 0.98/115VAC	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	PF=0.955/230VAC PF=0.988/115VAC
	P.F vs LOAD 			
6	EFFICIENCY(Typ.)	87.5%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	87.5%
	EFFICIENCY vs LOAD 			

7	INRUSH CURRENT(Typ.)	230V/85A 115V/45A COLD START	I/P： 230 VAC/50Hz I/P： 115 VAC/60Hz O/P：FULL LOAD Ta：25℃	I =80.5A/ 230VAC I =42.2A/ 115VAC T50=392us/230V
	INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH1 : Input current  	INPUT=115VAC/ 60HZ @ FULL LOAD CH2 : AC Input Voltage CH1 : Input current  		

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℃	129.7%/ 264VAC 129.7%/ 230VAC 130.3%/100VAC PROTECTION TYPE：Constant current limit, continous increase of load will be hiccup protection, recovers automatically after fault condition is removed.
2	OVER VOLTAGE PROTECTION	3.8V~4.6V	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P:MIN LOAD Ta:25℃	4.31V/ 264VAC 4.31V/ 230VAC 4.31V/ 100VAC PROTECTION TYPE ： Shut down o/p voltage，re-power on to recovery
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 264VAC I/P: 100VAC O/P:FULL LOAD	O.T.P. Active Protection type : Shut down o/p voltage，re-power on to recovers after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 100VAC O/P: FULL LOAD Ta:25℃	NO DAMAGE PROTECTION TYPE ： Hiccup mode, recovers automatically after fault condition is removed

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	DC OK CONTACT RATINGS	15VDC/10mA RESISTIVE LOAD	I/P:230VAC O/P:FULL LOAD Ta:25℃	TEST： OK
2	CURRENT SHARING (3.3V、4.2V、5V only)	｜PSU1-PSU2 ｜< 10%	I/P： 230 VAC O/P：FULL/50% LOAD Ta：25℃	O/P：100% PSU1： 29.71A PSU2： 27.89A O/P：50% PSU1： 16.98A PSU2： 15.00A

3	REDUNDANT CONTROL	over shoot /undershoot<10% RIPPLE & NOISE<1000mVp-p	I/P：100VAC/230VAC/264VAC O/P：NO LOAD /FULL LOAD Ta：25℃	O/P: FULL LOAD PSU1: -6.06% / 125mVp-p NOTE2 PSU2: -6.06% / 133mVp-p O/P: NO LOAD PSU1: 0% / 58 mVp-p PSU2: -4.85%/84mVp-p

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q2 Rated 11A/650V	AC ON/OFF I/P:High-Line +3V =267V VDS: O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz I/P:Low-Line -3V = 97V O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25℃	VDS: (1) 433V (2) 433V (3) 433V (4) 433V (5) 437V (6) 433V VDS: (1) 421V (2) 421V (3) 421V (4) 421V (5) 421V (6) 421V

2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q3 Rated 600V/12A	I/P:High-Line +3V =267 V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz I/P:Low-Line -3V = 97V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25℃	VDS: (1) 422V (2) 519V (3) 418V (4) 418V (5) 418V (6) 418V VDS: (1)499V (2)475V (3)499V (4)491V (5)503V (6)507V
4	P.F.C DIODE	D6 Rated 8A/600V	I/P:High-Line +3V =267 V AC ON/OFF 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 I/P:Low-Line -3V = 97V 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℃	 (1) 406V (2) 406V (3) 410V (4) 406V (1) 410V (2) 406V (3) 406V (4) 406V

5	SR MOS	Q100 Rated 100A/ 30 V Q104 Rated 100A/ 30 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/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7).NO LOAD Ta:25℃	Q100: VDS: (1)9.12V (2)7.92V (3)10.74V (4)10.74V (5)10.06V (6)11.38V (7) 7.68V	Q104: VDS: (1)8.64V (2)6.47V (3)9.21V (4)8.81V (5)8.89V (6)8.81V (7) 10.17V
6	Input Capacitor Voltage	C5 Rated: 56 μ / 420 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℃	(1)398V (2)390V (3)402V (4)386V	
7	Control IC Voltage Test	PWM IC U2 Rated 20V PFC IC U1 Rated 20V O/P IC U100 Rated 26 V	AC ON/OFF I/P:High-Line +3V =267 V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(LOW LINE) Ta:25℃	U1 U2 U100 (1)15.5V 16V 14.9V (2)15.6V 17V 12.3V (3)15.6V 16.8V 14.1V (4) 16V 16.4V 13.5V (5) 15.6V 16.2V 14.7V	
8	VCC Diode Peak Voltage	D20 Rated: 1A/200V D201 Rated: 1A/200V	I/P: High-Line +3V = 267VAC O/P: (1) FULL Load input on/off (2) Output Short (3) NO Load (4) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz	D20 D201 (1) 143.3V 45.2V (2) 156.9V 39.2V (3) 124.8V 54.5V (4) 126.4V 47.6V	

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: 4.2KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:1.5KVAC/min Ta:25℃	I/P-O/P: 3.07mA I/P-FG: 3.04mA O/P-FG: 2.73mA 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℃	6mΩ
4	Withstand surge input	I/P: 300VAC*5s	I/P: 310VAC*5s O/P: FULL LOAD/NO LOAD Ta:25℃	NO DAMAGE OK

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℃	PASS
2	CONDUCTION	EN55032 CLASS B	I/P： 230 VAC (50HZ) O/P：FULL/50% LOAD Ta：25℃	PASS Test by certified Lab
3	RADIATION	EN55032 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 HEAVY INDUSTRY Contact：4KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
5	E.F.T	EN61000-4-4 HEAVY INDUSTRY INPUT： 2KV	I/P： 230 VAC/50HZ O/P：FULL LOAD Ta：25℃	CRITERIA A
6	SURGE	IEC61000-4-5 HEAVY 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. Any contradictions of the test results please refer to the latest EMC test report.			

■ 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： LSP-160-5R
1. ROOM AMBIENT BURN-IN： 2HRS
I/P： 230VAC O/P： FULL LOAD Ta=26 ℃
2. HIGH AMBIENT BURN-IN： 2HRS
I/P： 230VAC O/P： FULL LOAD Ta=51.9 ℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=26 ℃</th><th>HIGH AMBIENT Ta=51.9 ℃</th></tr>
<tr><td>1</td><td>ZNR1</td><td>41.2℃</td><td>67.4℃</td></tr>
<tr><td>2</td><td>RTH2</td><td>61.0℃</td><td>81.7℃</td></tr>
<tr><td>3</td><td>L1</td><td>49.2℃</td><td>75.3℃</td></tr>
<tr><td>4</td><td>C5</td><td>47.0℃</td><td>73.4℃</td></tr>
<tr><td>5</td><td>C6</td><td>46.1℃</td><td>72.8℃</td></tr>
<tr><td>6</td><td>C22</td><td>47.3℃</td><td>74.2℃</td></tr>
<tr><td>7</td><td>C20</td><td>47.3℃</td><td>74.0℃</td></tr>
<tr><td>8</td><td>R20</td><td>49.9℃</td><td>76.8℃</td></tr>
<tr><td>9</td><td>BD1</td><td>62.5℃</td><td>87.4℃</td></tr>
<tr><td>10</td><td>Q2</td><td>48.3℃</td><td>75.2℃</td></tr>
<tr><td>11</td><td>Q3</td><td>48.9℃</td><td>75.7℃</td></tr>
<tr><td>12</td><td>D6</td><td>46.7℃</td><td>73.2℃</td></tr>
<tr><td>13</td><td>U1</td><td>47.4℃</td><td>73.9℃</td></tr>
<tr><td>14</td><td>U2</td><td>45.9℃</td><td>72.7℃</td></tr>
<tr><td>15</td><td>T1</td><td>61.0℃</td><td>88.9℃</td></tr>
<tr><td>16</td><td>Q101</td><td>52.4℃</td><td>79.6℃</td></tr>
<tr><td>17</td><td>Q104</td><td>53.7℃</td><td>81.1℃</td></tr>
<tr><td>18</td><td>U100</td><td>53.3℃</td><td>80.3℃</td></tr>
<tr><td>19</td><td>J103</td><td>55.7℃</td><td>84.5℃</td></tr>
<tr><td>20</td><td>C106</td><td>57.5℃</td><td>85.9℃</td></tr>
<tr><td>21</td><td>C107</td><td>58.5℃</td><td>86.8℃</td></tr>
<tr><td>22</td><td>RTH3</td><td>46.6℃</td><td>73.4℃</td></tr>
<tr><td>23</td><td>C13</td><td>46.7℃</td><td>72.8℃</td></tr>
<tr><td>24</td><td>Q201</td><td>52.1℃</td><td>80.1℃</td></tr>
<tr><td>25</td><td>TC</td><td>42.1℃</td><td>68.6℃</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：125.6%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/110VAC
O/P：100% LOAD
Ta= -35℃</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℃ / 95 %R.H
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>± 0.0156%/℃ (0~50℃)</td></tr>
</table>

6	STORAGE TEMPERATURE TEST	-40~85℃	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：10 CYCLE 5. Input/Output condition： STATIC
7	THERMAL SHOCK TEST	-30~50℃	1. Thermal shock Temperature： -35℃~ +55℃ 2. Temperature change rate ：25℃ / 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
8	VIBRATION TEST	10 ~ 500Hz, 5G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (3) Sweep Time：12min/sweep cycle (4) Acceleration：6G (5) Test Time：180min in each axis (X.Y.Z) (6) Ta：25℃
9	CAPACITOR LIFE CYCLE	LSP-160-5R：SUPPOSE C107 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) 4742747HRS (2) 202316HRS (3) 726156HRS (4) 2167854HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 699.54 K hrs min. Telcordia SR-332 (Bellcore) 282.71K hrs min. MIL-HDBK-217F (25℃)	
11	Ongoing Reliability Test	I/P：230VAC O/P：FULL LOAD TA=50℃ Demonstration Mean Time Between Failure : 30,000 hours	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	WUWQ/ZHOUBIAO	WENF	LIUWY

2018.4.30 GP-A50-F010