Test Report: LSP-160-12

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

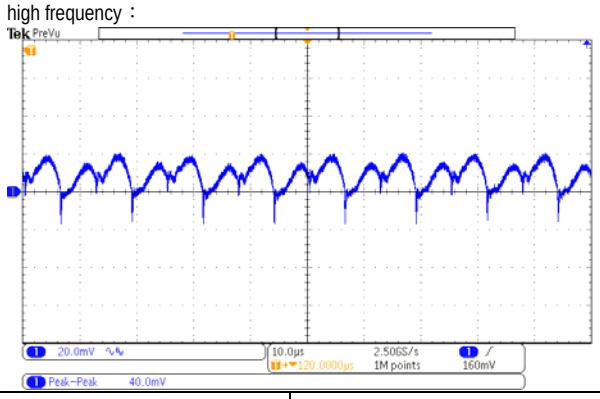
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

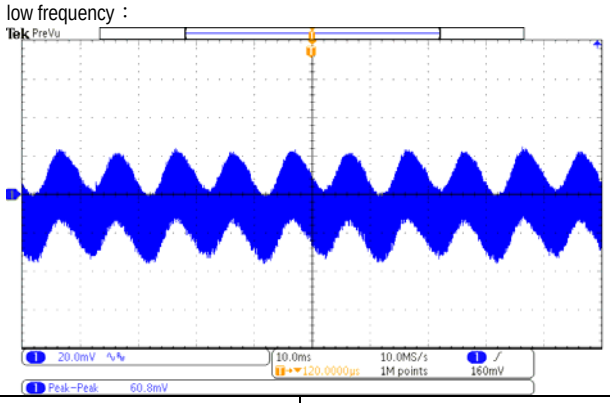
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	11.4V ~ 12.6V	I/P： 230 VAC O/P：MIN LOAD Ta：25℃	10.91V~13.16V/230VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	-1% ~ 1%	I/P: 90VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25℃	0.58 %~ 0.75 %
3	LINE REGULATION (Max)	-0.3% ~ 0.3%	I/P: 90VAC~ 264VAC O/P:FULL LOAD Ta:25℃	0 %~ 0 %
4	LOAD REGULATION(Max)	-0.5% ~ 0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	-0.08 %~ 0.08 %
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	3.4%
6	RIPPLE & NOISE(Max)	240 mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	60.8mVp-p

high frequency：



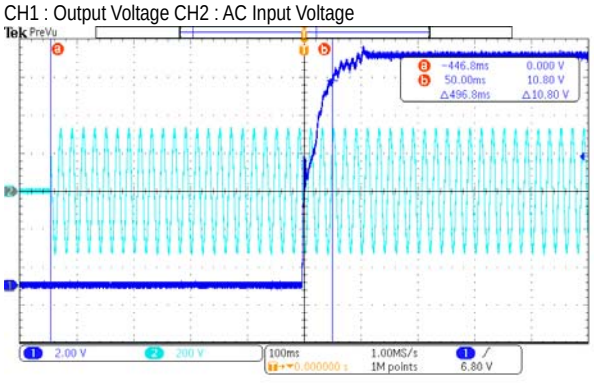
low frequency：



7	SET UP TIME(Max)	230VAC/2000ms 115VAC/3000ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 496.8 ms 115VAC/ 668.0 ms

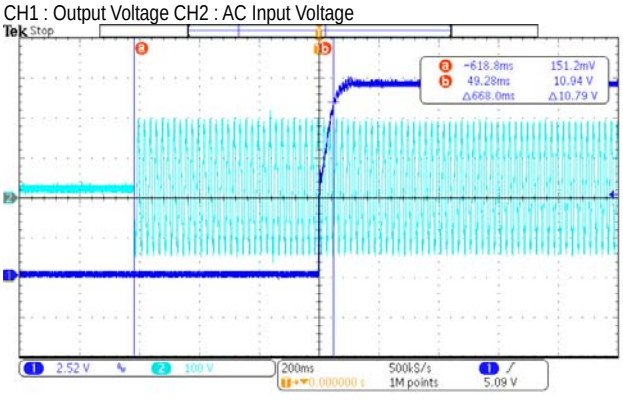
INPUT=230VAC/50HZ @ FULL LOAD

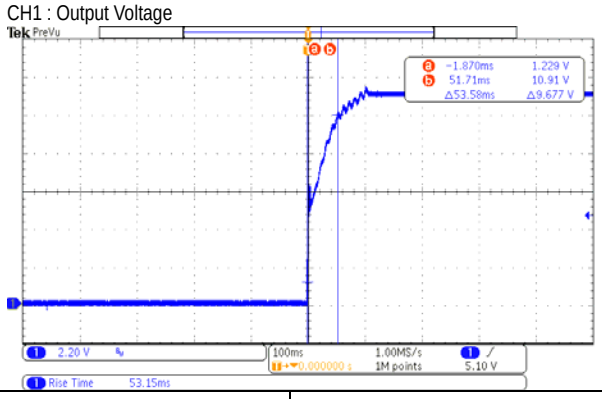
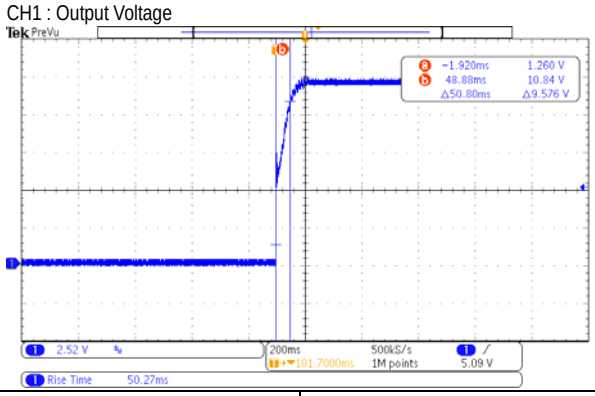
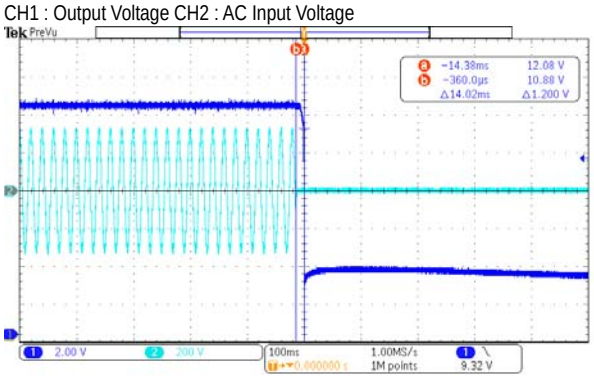
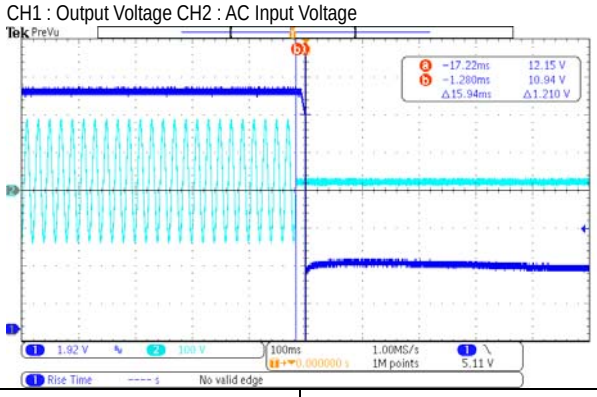
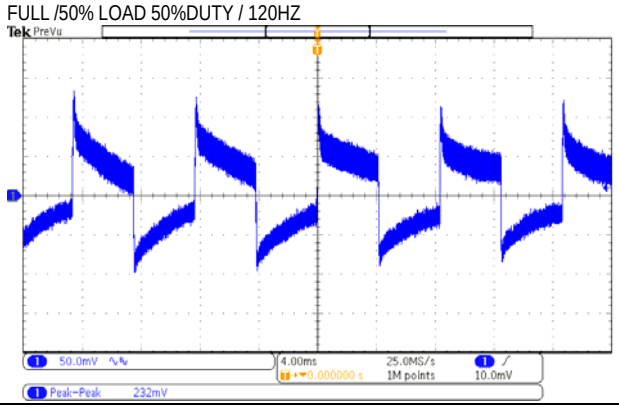
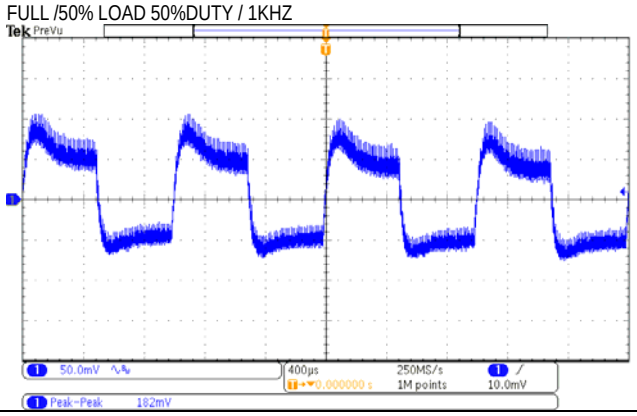
CH1 : Output Voltage CH2 : AC Input Voltage



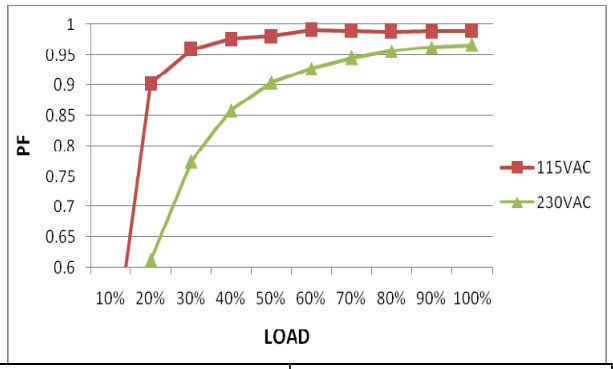
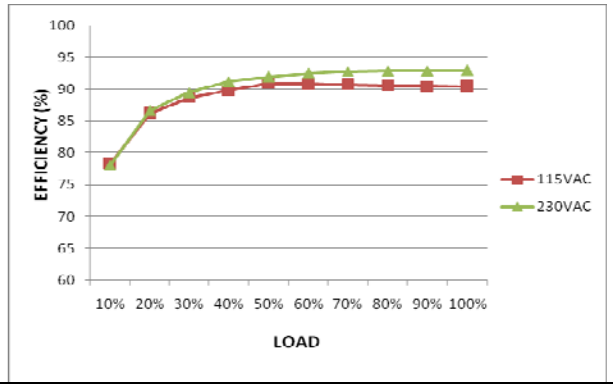
INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



8	RISE TIME (Max)	230VAC/80ms 115VAC/80ms	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 53.58 ms 115VAC/ 50.80 ms
	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/ 14.02 ms 115VAC/ 15.94ms
	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: 1200mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25℃	(1) 232mVp-p (2) 182mVp-p
	FULL /50% LOAD 50%DUTY / 120HZ 		FULL /50% LOAD 50%DUTY / 1KHZ 	

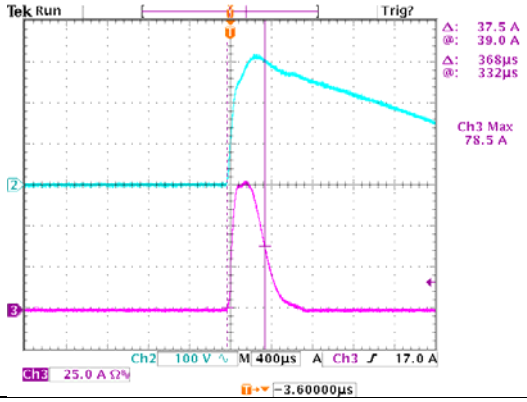
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	100VAC~264VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	95V~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.)	230V/ 1.1A 115V/ 2.2A	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	I =0.79A/ 230VAC I =1.64A/ 115VAC
4	LEAKAGE CURRENT	<0.75 mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	L-FG： 0.2404mA N-FG： 0.2409mA
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=0.973/230VAC PF=0.993/115VAC
	P.F vs LOAD 			
6	EFFICIENCY(Typ.)	92.5%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	92.95%
	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 =78.5A/ 230VAC I =37.0A/ 115VAC T50=368 us/230V

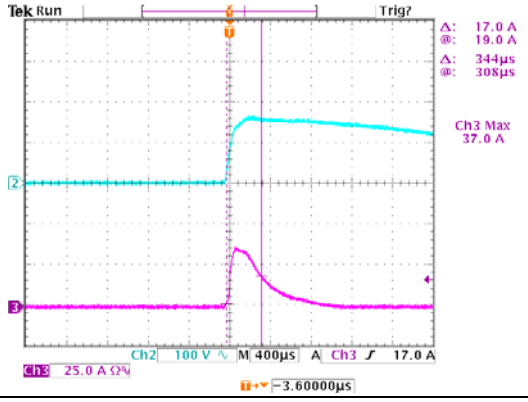
INPUT=230VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current



INPUT=115VAC/ 60HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : 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℃	116.67%/ 264VAC 116.81%/ 230VAC 116.81%/100VAC PROTECTION TYPE： Constant current limiting,continous increase of load will be hiccup protection, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	13.2V~15.6V	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P:MIN LOAD Ta:25℃	14.651V/ 264VAC 14.620V/ 230VAC 14.736V/ 100VAC PROTECTION TYPE ： Shut down o/p voltage，re-power on to recovery
3	OVER TEMPERATURE PROTECTION	Protection type : NO DAMAGE	I/P: 264VAC I/P: 100VAC O/P:FULL LOAD	O.T.P. Active OK 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 OK 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

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q2 Rated 11 A/ 650 V	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)498V (2)498V (3)496V (4)496V (5)494V (6)504V VDS: (1)466V (2)478V (3)486V (4)480V (5)486V (6)482V
2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q3 Rated 12A/600 V	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)440V (2)442V (3)440V (4)440V (5)438V (6)436V VDS: (1)452V (2)416V (3)472V (4)470V (5)462V (6)440V

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) 392V (3) 412V (4) 402V (1) 410V (2) 402V (3) 408V (4) 404V
5	SR MOS	Q100 Rated 100A/ 40V Q104 Rated 100A/ 40V	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℃	Q101: VDS: (1)26.8V (2)10.2V (3)27.3V (4)27.1V (5)27.0V (6)27.0V (7) 26.8V
				Q104: VDS: (1)28.5V (2)9.10V (3)28.7V (4)28.4V (5)28.3V (6)33.1V (7) 25.2V
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)411V (2)398V (3)413V (4)400 V
7	Control IC Voltage Test	PWM IC U2 Rated 20 V 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)15.2V 15.9V 14.6V (2)15.1V 16.9V 6.04V (3)15.3V 16.4V 14.6V (4)15.1 V 15.7V 14.3V (5) 15.1V 15.7V 14.4V
8	VCC Diode Peak Voltage	D20 Rated: :1A/200V D201 Rated: :1A/200V	I/P: High-Line +3V = 267VAC O/P: (1) FULLLoad input on/off (2) Output Short (3) NO Load (4) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz	D20 D201 (1) 80.1 V 73.2V (2) 88.9V 23.1V (3) 86.8 V 68.0V (4)85.6V 72.8V

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:2.916mA I/P-FG:2.633mA O/P-FG:2.769m 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℃	2 mΩ
4	Withstand surge input	I/P: 300VAC*5s	I/P: 310VAC*5s O/P: FULL LOAD/NO LOAD Ta:25℃	NO DAMAGE

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-160-24
1. ROOM AMBIENT BURN-IN：2 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 26.5 ℃
2. HIGH AMBIENT BURN-IN： 2 HRS
I/P： 230VAC O/P： FULL LOAD Ta= 52.6 ℃
<table>
<tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=26.5 ℃</th><th>HIGH AMBIENT Ta=52.6 ℃</th></tr>
<tr><td>1</td><td>ZNR1</td><td>40.8℃</td><td>65.5℃</td></tr>
<tr><td>2</td><td>RTH2</td><td>62.4℃</td><td>81.9℃</td></tr>
<tr><td>3</td><td>L1</td><td>48.7℃</td><td>73.0℃</td></tr>
<tr><td>4</td><td>C5</td><td>45.7℃</td><td>70.5℃</td></tr>
<tr><td>5</td><td>C6</td><td>45.3℃</td><td>70.1℃</td></tr>
<tr><td>6</td><td>C22</td><td>46.8℃</td><td>72.0℃</td></tr>
<tr><td>7</td><td>C20</td><td>46.6℃</td><td>71.6℃</td></tr>
<tr><td>8</td><td>R20</td><td>49.1℃</td><td>74.5℃</td></tr>
<tr><td>9</td><td>BD1</td><td>66.7℃</td><td>90.1℃</td></tr>
<tr><td>10</td><td>Q2</td><td>49.9℃</td><td>75.9℃</td></tr>
<tr><td>11</td><td>Q3</td><td>50.5℃</td><td>75.7℃</td></tr>
<tr><td>12</td><td>D6</td><td>49.4℃</td><td>74.2℃</td></tr>
<tr><td>13</td><td>U1</td><td>47.1℃</td><td>72.0℃</td></tr>
<tr><td>14</td><td>U2</td><td>46.3℃</td><td>71.6℃</td></tr>
<tr><td>15</td><td>T1core</td><td>54.9℃</td><td>80.3℃</td></tr>
<tr><td>16</td><td>Q100</td><td>46.1℃</td><td>71.5℃</td></tr>
<tr><td>17</td><td>Q104</td><td>46.4℃</td><td>71.7℃</td></tr>
<tr><td>18</td><td>J103</td><td>45.3℃</td><td>70.5℃</td></tr>
<tr><td>19</td><td>C106</td><td>42.6℃</td><td>67.8℃</td></tr>
<tr><td>20</td><td>C107</td><td>43.8℃</td><td>68.9℃</td></tr>
<tr><td>21</td><td>RTH3</td><td>46.6℃</td><td>71.5℃</td></tr>
<tr><td>22</td><td>C13</td><td>46.8℃</td><td>70.4℃</td></tr>
<tr><td>23</td><td>TC</td><td>39.3℃</td><td>64.4℃</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：123.1% 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>± 0.008 %/℃ (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-160-24：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) 27291663HRS (2) 1721988HRS (3) 2349795HRS (4) 3133502HRS
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