Test Report: LPF-16D-15

16W 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	VERDICT
1	RIPPLE & NOISE	V1：150 mVp-p (Max)	I/P： 230VAC O/P：FULL LOAD Ta：25℃	V1： 22 mVp-p (Max)	P
2	CONSTANT CURRENT REGION	V1= 7.5V~15V	I/P： 230VAC O/P：CV MODE Ta：25℃	O/P= 7.5V： 1.094 A O/P= 14V： 1.092 A	P
3	OUTPUT VOLTAGE TOLERANCE	V1： 4 %~ -4 % (Max)	I/P：100 VAC / 305 VAC O/P：FULL/ MIN LOAD Ta：25℃	V1： 0.807 %~ -0.213 %	P
4	LINE REGULATION	V1： 0.5 %~ -0.5 % (Max)	I/P：100 VAC ~ 305 VAC O/P：FULL LOAD Ta：25℃	V1： 0.007 %~ -0.007 %	P
5	LOAD REGULATION	V1：1.5 %~ -1.5 % (Max)	I/P： 230 VAC O/P：FULL ~MIN LOAD Ta：25℃	V1： 0.100 %~ -0.113 %	P
6	SET UP TIME	230VAC： 500 ms (Max) 115VAC： 1500 ms(Max)	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 337.722 ms 115VAC/ 385.473 ms	P
7	RISE TIME	230VAC： 80 ms (Max) 115VAC： 80 ms (Max)	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 8 ms 115VAC/ 8 ms	P
8	HOLD UP TIME	230VAC： 16 ms (TYP) 115VAC： 16 ms (TYP)	I/P： 230 VAC I/P： 115 VAC O/P：FULL LOAD Ta：25℃	230VAC/ 120 ms 115VAC/ 121 ms	P
9	OVER/UNDERSHOOT TEST	< ±5%	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	TEST： <5 %	P
10	DYNAMIC LOAD	V1： 1500 mVp-p	I/P： 230 VAC (1).O/P：FULL /Min LOAD 90%DUTY/ 1KHZ (2).O/P：FULL /Min LOAD 50%DUTY/ 120HZ Ta：25℃	(1) 181 mVp-p (2) 291 mVp-p	P

11 DIMMER TEST

SPEC:

*Output constant current level can be adjusted through output cable by 1 ~ 10Vdc, PWM signal or resistor between ADJ1(+) and ADJ2(-).

*Reference resistance value for output current adjustment (Typical)

Resistance value	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

*1 ~ 10V dimming function for output current adjustment (Typical)

Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

*10V PWM signal for output current adjustment (Typical)

Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

TEST RESULT: I/P： 230 VAC ;Ta：25℃

P

1	Resistance value	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
	Output current	0.083A	0.193A	0.298A	0.413A	0.525A	0.634A	0.741A	0.857A	0.966A	1.061A
	%	7.76%	18.04%	27.85%	38.60%	49.07%	59.25%	69.25%	80.09%	90.28%	99.16%
2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
	Output current	0.085A	0.195A	0.304A	0.417A	0.528A	0.638A	0.747A	0.860A	0.970A	1.068A
	%	7.94%	18.22%	28.41%	38.97%	49.35%	59.63%	69.81%	80.37%	90.65%	99.81%
3	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	Output current	0.086A	0.197A	0.308A	0.419A	0.531A	0.642A	0.752A	0.864A	0.974A	1.073A
	%	8.04%	18.41%	28.79%	39.16%	49.63%	60.00%	70.28%	80.75%	91.03%	100.3%

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	100VAC~305 VAC	I/P：TESTING O/P：FULL LOAD Ta：25℃	85 V~305V	P
			I/P： LOW-LINE-3V=97 V HIGH-LINE=305 V O/P：FULL/MIN LOAD ON： 30 Sec . OFF： 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE)	TEST： OK	
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P： 100 VAC ~ 305 VAC O/P：FULL~MIN LOAD Ta：25℃	TEST： OK	P
3	POWER FACTOR	0.95 / 230 VAC(TYP) 0.97 / 115 VAC(TYP) 0.92 / 277 VAC(TYP)	I/P： 230 VAC I/P： 115 VAC I/P： 277 VAC O/P：FULL LOAD Ta：25℃	PF= 0.973 / 100% PF= 0.995 / 100% PF= 0.938 / 100%	P
4	EFFICIENCY	83% (TYP)	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	83.54 %	P
5	INPUT CURRENT	230V/ 0.25 A (TYP) 115V/ 0.4 A (TYP) 277V/ 0.2 A (TYP)	I/P： 230 VAC I/P： 115 VAC I/P： 277 VAC O/P：FULL LOAD Ta：25℃	I = 0.083 A/ 230 VAC I = 0.164 A/ 115 VAC I = 0.071 A/ 277 VAC	P
6	INRUSH CURRENT	230V/ 50 A (TYP) COLD START	I/P： 230 VAC O/P：FULL LOAD Ta：25℃	I = 36.0 A/ 230 VAC	P
7	LEAKAGE CURRENT	< 0.75 mA / 240 VAC	I/P： 240 VAC O/P：Min LOAD Ta：25℃	L-CASE： 0.003 mA N-CASE： 0.003 mA	P

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	95 % ~ 108 %	I/P： 230 VAC I/P： 115 VAC O/P：TESTING Ta：25℃	102.26 %/ 230 VAC 102.25 %/ 115 VAC Constant Current Limiting ,recovers automatically after fault condition is removed.	P
2	OVER VOLTAGE PROTECTION	CH1： 17.5 V ~ 21 V	I/P： 230 VAC I/P： 115 VAC O/P：MIN LOAD Ta：25℃	19.1 V/ 230 VAC 19.1 V/ 115 VAC Shut down and latch off o/p voltage, re-power on to recover	P
3	OVER TEMPERATURE PROTECTION	SPEC： TSW1： 100± 5℃ O.T.P. NO DAMAGE	I/P： 230 VAC O/P：FULL LOAD	O.T.P. Active Shut down o/p voltage，recovers automatically after temperature goes down	P
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P： 305 VAC O/P：FULL LOAD Ta：25℃	NO DAMAGE Hiccup mode, recovers automatically after fault condition is removed.	P

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) Peak Voltage	U2 Rated： IP7518: 700V / 2A	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on (2) Output Short (3)Full load continue Ta：25℃	(1) 640 V (2) 486 V (3) 632 V	P
2	Diode Peak Voltage	D101 Rated： YG868C08: 80V / 30A	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on (2)Output Short (3)Full load continue Ta：25℃	(1) 64.0 V (2) 40.6 V (3) 63.6 V	P
3	Input Capacitor Voltage	C5 Rated： 22u/450V 105℃ 16*20 RH	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta：25℃	(1) 436 V (2) 440 V (3) 428 V	P
4	Control IC Voltage Test	U 2 Rated： IP7518:30V	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta：25℃	(1) 21.2 V (2) 13.9 V (3) 19.5 V	P
5	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated： NDF10N60ZG: 600V/ 10 A	I/P：High-Line +3V = 308 V O/P： (1)Full Load Turn on (2) Output Short (3)Full load continue Ta：25℃	(1) 494 V (2) 424 V (3) 440 V	P

■ SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P： 3.75 KVAC/min	I/P-O/P： 4 KVAC/min Ta：25℃	I/P-O/P： 1.459 mA NO DAMAGE	P
2	ISOLATION RESISTANCE	I/P-O/P：500VDC>100MΩ	I/P-O/P： 500 VDC Ta：25℃/70%RH	I/P-O/P： >9999 MΩ NO DAMAGE	P
3	APPROVAL	TUV： Certificate NO ： UL： File NO ：			N/A

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS C	I/P:230VAC/240VAC/220VAC50HZ O/P:100%,75%,50%LOAD CLASS C ≧50% Ta:25℃	PASS	P
2	CONDUCTION	EN55015	I/P: 230 VAC (50HZ)/115V[60HZ] O/P:FULL/50% LOAD Ta:25℃	PASS Test by certified Lab	P
3	RADIATION	EN55015	I/P: 230 VAC (50HZ)/115V[60HZ] O/P:FULL LOAD Ta:25℃	PASS Test by certified Lab	P
4	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A	P
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 1KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A	P
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A	P
7	Test by certified Lab & Test Report Prepare				

■ RELIABILITY TEST

ENVIRONMENT TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECIFICATION</th><th>TEST CONDITION</th><th>RESULT</th><th>VERDICT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL： LPF-16D-12
1. ROOM AMBIENT BURN-IN：2.5 HRS
I/P： 230VAC O/P： 95% LOAD Ta=32.2 ℃
2. HIGH AMBIENT BURN-IN：3.5 HRS
I/P： 230VAC O/P： 95% LOAD Ta=50.1 ℃
<table>
<tr><th>NO</th><th>Position</th><th>P/N</th><th>ROOM AMBIENT Ta= 32.2 ℃</th><th>HIGH AMBIENT Ta= 50.1 ℃</th></tr>
<tr><td>1</td><td>LF2</td><td>LF-802</td><td>55.6℃</td><td>72.5℃</td></tr>
<tr><td>2</td><td>BD1</td><td>UD2KB80</td><td>62.2℃</td><td>77.8℃</td></tr>
<tr><td>3</td><td>L1</td><td>TR-6102</td><td>62.3℃</td><td>78.1℃</td></tr>
<tr><td>4</td><td>Q1</td><td>NDF10N60ZG</td><td>66.6℃</td><td>82.5℃</td></tr>
<tr><td>5</td><td>D1</td><td>MUR460</td><td>69.4℃</td><td>86.1℃</td></tr>
<tr><td>6</td><td>C18</td><td>47uF/50V YXM</td><td>66.8℃</td><td>83.0℃</td></tr>
<tr><td>7</td><td>C54</td><td>22uF/50V YXM</td><td>70.2℃</td><td>87.5℃</td></tr>
<tr><td>8</td><td>C5</td><td>22uF/450V RH</td><td>68.3℃</td><td>86.2℃</td></tr>
<tr><td>9</td><td>U1</td><td>NCP1608B</td><td>68.9℃</td><td>84.8℃</td></tr>
<tr><td>10</td><td>U2</td><td>IP7518</td><td>86.8℃</td><td>104.8℃</td></tr>
<tr><td>11</td><td>T1</td><td>TF-6357</td><td>70.4℃</td><td>87.1℃</td></tr>
<tr><td>12</td><td>D101</td><td>PFR30L60CT 30A/60V</td><td>63.5℃</td><td>78.8℃</td></tr>
<tr><td>13</td><td>C105</td><td>560u/25V ZLH</td><td>59.9℃</td><td>75.9℃</td></tr>
</table></td><td>P</td></tr>
<tr><td>2</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2 HOUR</td><td>I/P： 305VAC/100VAC
O/P： 95 % LOAD
Ta= -40℃</td><td>TEST：OK</td><td>P</td></tr>
<tr><td>3</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： 305 VAC
O/P：95% LOAD
Ta= 50 ℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td><td>P</td></tr>
<tr><td>4</td><td>TEMPERATURE
COEFFICIENT</td><td>± 0.03 %(0~50℃)</td><td>I/P： 230 VAC
O/P：95% LOAD</td><td>± 0.002 %(0~50℃)</td><td>P</td></tr>
<tr><td>5</td><td>STORAGE TEMPERATURE TEST</td><td colspan="2">1. Thermal shock Temperature： -45℃~ +85℃
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><td>P</td></tr>
<tr><td>6</td><td>THERMAL SHOCK TEST</td><td colspan="2">1. Thermal shock Temperature： -45℃~ +55℃
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</td><td>OK</td><td>P</td></tr>
</table>

7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (3) Sweep Time：12min/sweep cycle (4) Acceleration：2G (5) Test Time：72min in each axis (X.Y.Z) (6) Ta：25℃	TEST：OK	P
8	CAPACITOR LIFE CYCLE	LPF-16-12:SUPPOSE C105 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	(1) 452611.8 HRS (2) 91294.2 HRS (3) 119635.2 HRS	P
9	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE：420.1KHRS		P
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase70℃		P

SAMPLE	TEST RESULT	TESTER	APPROVAL
PRODUCT SAMPLE	PASS	ZOULF	HOWAY

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