



# Test Report: LPF-16D-20

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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<br>O/P : FULL LOAD<br>Ta : 25°C  | V1 : 20 mVp-p (Max)                      | P       |
| 2  | CONSTANT CURRENT REGION  | V1= 10V-20V                                    | I/P : 230VAC<br>O/P : CV MODE<br>Ta : 25°C  | O/P= 10V : 0.825 A<br>O/P= 19V : 0.824 A | P       |
| 3  | OUTPUT VOLTAGE TOLERANCE | V1 : 4 %~ -4 % (Max)                           | I/P : 100 VAC / 305 VAC<br>O/P : FULL/ MIN LOAD<br>Ta : 25°C  | V1 : 0.950 %~ -0.120 %                   | P       |
| 4  | LINE REGULATION          | V1 : 0.5 %~ -0.5 % (Max)                       | I/P : 100 VAC ~ 305 VAC<br>O/P : FULL LOAD<br>Ta : 25°C   | V1 : 0.005 %~ -0.005 %                   | P       |
| 5  | LOAD REGULATION          | V1 : 1 %~ -1 % (Max)                           | I/P : 230 VAC<br>O/P : FULL ~MIN LOAD<br>Ta : 25°C  | V1 : 0.060 %~ -0.060 %                   | P       |
| 6  | SET UP TIME              | 230VAC : 500 ms (Max)<br>115VAC : 1500 ms(Max) | I/P : 230 VAC<br>I/P : 115 VAC<br>O/P : FULL LOAD<br>Ta : 25°C  | 230VAC/ 319.904 ms<br>115VAC/ 302.274 ms | P       |
| 7  | RISE TIME                | 230VAC : 80 ms (Max)<br>115VAC : 80 ms (Max)   | I/P : 230 VAC<br>I/P : 115 VAC<br>O/P : FULL LOAD<br>Ta : 25°C  | 230VAC/ 12 ms<br>115VAC/ 12 ms           | P       |
| 8  | HOLD UP TIME             | 230VAC : 16 ms (TYP)<br>115VAC : 16 ms (TYP)   | I/P : 230 VAC<br>I/P : 115 VAC<br>O/P : FULL LOAD<br>Ta : 25°C  | 230VAC/ 125 ms<br>115VAC/ 125 ms         | P       |
| 9  | OVER/UNDERSHOOT TEST     | < ±5%  | I/P : 230 VAC<br>O/P : FULL LOAD<br>Ta : 25°C   | TEST : <5 %                              | P       |
| 10 | DYNAMIC LOAD             | V1 : 2000 mVp-p                                | I/P : 230 VAC<br>(1).O/P : FULL /Min LOAD 90%DUTY/<br>1KHZ<br>(2).O/P : FULL /Min LOAD 50%DUTY/<br>120HZ<br>Ta : 25°C | (1) 171 mVp-p<br>(2) 308 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°C |                  |   |        |        |        |        |        |        |        |        |        |      |
| 1                                      | Resistance value | 10K   | 20K    | 30K    | 40K    | 50K    | 60K    | 70K    | 80K    | 90K    | 100K   |      |
|  | Output current   | 0.064A  | 0.144A | 0.222A | 0.302A | 0.389A | 0.470A | 0.552A | 0.635A | 0.720A | 0.795A |      |
|  | %                | 8.00%   | 18.00% | 27.75% | 37.75% | 48.63% | 58.75% | 69.00% | 79.38% | 90.00% | 99.38% |      |
| 2                                      | Dimming value    | 1V  | 2V     | 3V     | 4V     | 5V     | 6V     | 7V     | 8V     | 9V     | 10V    |      |
|  | Output current   | 0.066A  | 0.145A | 0.225A | 0.304A | 0.391A | 0.473A | 0.555A | 0.638A | 0.723A | 0.801A |      |
|  | %                | 8.25%   | 18.13% | 28.13% | 38.00% | 48.88% | 59.13% | 69.38% | 79.75% | 90.34% | 100.1% |      |
| 3                                      | Duty value       | 10%   | 20%    | 30%    | 40%    | 50%    | 60%    | 70%    | 80%    | 90%    | 100%   |      |
|  | Output current   | 0.068A  | 0.147A | 0.227A | 0.305A | 0.393A | 0.477A | 0.560A | 0.641A | 0.727A | 0.804A |      |
|  | %                | 8.50%   | 18.34% | 28.38% | 38.13% | 49.13% | 59.63% | 70.00% | 80.13% | 90.88% | 100.5% |      |

P

**INPUT FUNCTION TEST**

| NO | TEST ITEM             | SPECIFICATION   | TEST CONDITION  | RESULT   | VERDICT |
|----|-----------------------|---|---|--|---------|
| 1  | INPUT VOLTAGE RANGE   | 100VAC~305 VAC  | I/P : TESTING<br>O/P : FULL LOAD<br>Ta : 25°C<br><br>I/P :<br>LOW-LINE-3V=97 V<br>HIGH-LINE=305 V<br>O/P : FULL/MIN LOAD<br>ON : 30 Sec . OFF : 30 Sec 10MIN<br>( AC POWER ON/OFF NO DAMAGE ) | 85 V~305V<br><br>TEST : OK   | P       |
| 2  | INPUT FREQUENCY RANGE | 47HZ ~63 HZ<br>NO DAMAGE OSC                                      | I/P : 100 VAC ~ 305 VAC<br>O/P : FULL-MIN LOAD<br>Ta : 25°C   | TEST : OK  | P       |
| 3  | POWER FACTOR          | 0.95 / 230 VAC(TYP)<br>0.97 / 115 VAC(TYP)<br>0.92 / 277 VAC(TYP) | I/P : 230 VAC<br>I/P : 115 VAC<br>I/P : 277 VAC<br>O/P : FULL LOAD<br>Ta : 25°C   | PF= 0.967 / 100%<br>PF= 0.995 / 100%<br>PF= 0.937 / 100%             | P       |
| 4  | EFFICIENCY            | 84.5% (TYP)   | I/P : 230 VAC<br>O/P : FULL LOAD<br>Ta : 25°C   | 84.55 %  | P       |
| 5  | INPUT CURRENT         | 230V/ 0.25 A (TYP)<br>115V/ 0.4 A (TYP)<br>277V/ 0.2 A (TYP)      | I/P : 230 VAC<br>I/P : 115 VAC<br>I/P : 277 VAC<br>O/P : FULL LOAD<br>Ta : 25°C   | I = 0.083 A/ 230 VAC<br>I = 0.162 A/ 115 VAC<br>I = 0.071 A/ 277 VAC | P       |
| 6  | INRUSH CURRENT        | 230V/ 50 A (TYP)<br>COLD START                                    | I/P : 230 VAC<br>O/P : FULL LOAD<br>Ta : 25°C   | I = 34.1 A/ 230 VAC  | P       |
| 7  | LEAKAGE CURRENT       | < 0.75 mA / 240 VAC   | I/P : 240 VAC<br>O/P : Min LOAD<br>Ta : 25°C  | L-CASE : 0.003 mA<br>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<br>I/P : 115 VAC<br>O/P : TESTING<br>Ta : 25°C  | 103.16 %/ 230 VAC<br>103.18%/ 115 VAC<br>Constant Current Limiting ,recovers automatically after fault condition is removed. | P       |
| 2  | OVER VOLTAGE PROTECTION     | CH1 : 23 V ~ 27 V                            | I/P : 230 VAC<br>I/P : 115 VAC<br>O/P : MIN LOAD<br>Ta : 25°C | 25.8 V/ 230 VAC<br>25.8 V/ 115 VAC<br>Shut down and latch off o/p voltage, re-power on to recover                            | P       |
| 3  | OVER TEMPERATURE PROTECTION | SPEC :<br>TSW1 : 100±5°C O.T.P.<br>NO DAMAGE | I/P : 230 VAC<br>O/P : FULL LOAD                              | O.T.P. Active<br>Shut down o/p voltage , recovers automatically after temperature goes down                                  | P       |
| 4  | SHORT PROTECTION            | SHORT EVERY OUTPUT<br>1 HOUR NO DAMAGE       | I/P : 305 VAC<br>O/P : FULL LOAD<br>Ta : 25°C                 | NO DAMAGE<br>Hiccup mode, recovers automatically after fault condition is removed.   | P       |

**COMPONENT STRESS TEST**

| NO | TEST ITEM  | SPECIFICATION                         | TEST CONDITION   | RESULT                                 | VERDICT |
|----|--|---------------------------------------|--|--|---------|
| 1  | Power Transistor<br>( D to S) or (C to E) Peak Voltage | U2 Rated :<br>IP7518: 700V / 2A       | I/P : High-Line +3V = 308 V<br>O/P : (1)Full Load Turn on<br>(2) Output Short<br>(3)Full load continue<br>Ta : 25°C                          | (1) 632 V<br>(2) 460 V<br>(3) 616 V    | P       |
| 2  | Diode Peak Voltage                                     | D101 Rated :<br>V30100C: 100V / 30A   | I/P : High-Line +3V = 308 V<br>O/P : (1)Full Load Turn on<br>(2)Output Short<br>(3)Full load continue<br>Ta : 25°C                           | (1) 78.4 V<br>(2) 60.4 V<br>(3) 76.8 V | P       |
| 3  | Input Capacitor Voltage                                | C5 Rated :<br>22u/450V 105°C 16*20 RH | I/P : High-Line +3V = 308 V<br>O/P : (1)Full Load Turn on /Off<br>(2) Min load Turn on /Off<br>(3)Full Load /Min load<br>Change<br>Ta : 25°C | (1) 440 V<br>(2) 438 V<br>(3) 428 V    | P       |
| 4  | Control IC Voltage Test                                | U 2 Rated :<br>IP7518:30V             | I/P : High-Line +3V = 308 V<br>O/P : (1)Full Load Turn on /Off<br>(2) Min load Turn on /Off<br>(3)Full Load /Min load<br>Change<br>Ta : 25°C | (1) 19.9 V<br>(2) 13.2 V<br>(3) 19.4 V | P       |
| 5  | Power Transistor<br>( D to S) or (C to E) Peak Voltage | Q1 Rated :<br>NDF10N60ZG: 600V/ 10 A  | I/P : High-Line +3V = 308 V<br>O/P : (1)Full Load Turn on<br>(2) Output Short<br>(3)Full load continue<br>Ta : 25°C                          | (1) 466 V<br>(2) 428 V<br>(3) 442 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<br>Ta : 25°C     | I/P-O/P : 1.442 mA<br><br>NO DAMAGE | P       |
| 2  | ISOLATION RESISTANCE | I/P-O/P : 500VDC>100MΩ                   | I/P-O/P : 500 VDC<br>Ta : 25°C/70% RH | I/P-O/P : >9999 MΩ<br><br>NO DAMAGE | P       |
| 3  | APPROVAL             | TUV : Certificate NO :<br>UL : File NO : |                                       |                                     | N/A     |

**E.M.C TEST**

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

■ RELIABILITY TEST

**ENVIRONMENT TEST**

| NO | TEST ITEM   | SPECIFICATION  | TEST CONDITION  | RESULT            | VERDICT |
|----|---|--|---|-------------------|---------|
| 1  | TEMPERATURE RISE TEST   | MODEL : LPF-16D-12<br>1. ROOM AMBIENT BURN-IN : 2.5 HRS<br>I/P : 230VAC O/P : 95% LOAD Ta=32.2 °C<br>2. HIGH AMBIENT BURN-IN : 3.5 HRS<br>I/P : 230VAC O/P : 95% LOAD Ta=50.1 °C   |   |                   | P       |
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| 2  | LOW TEMPERATURE TURN ON TEST                                      | TURN ON AFTER 2 HOUR   | I/P : 305VAC/100VAC<br>O/P : 95 % LOAD<br>Ta= -40°C               | TEST : OK         | P       |
| 3  | HIGH HUMIDITY<br>HIGH TEMPERATURE<br>HIGH VOLTAGE<br>TURN ON TEST | AFTER 12 HOURS<br>IN CHAMBER ON<br>CONTROL 50 °C<br>NO DAMAGE  | I/P : 305 VAC<br>O/P : 95% LOAD<br>Ta= 50 °C<br>HUMIDITY= 95 %R.H | TEST : OK         | P       |
| 4  | TEMPERATURE COEFFICIENT   | ± 0.03 %(0~50°C)   | I/P : 230 VAC<br>O/P : 95% LOAD                                   | ± 0.002 %(0~50°C) | P       |
| 5  | STORAGE TEMPERATURE TEST  | 1. Thermal shock Temperature : -45°C~ +85°C<br>2. Temperature change rate : 25°C / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 5 CYCLE<br>5. Input/Output condition : STATIC  |   | OK                | P       |
| 6  | THERMAL SHOCK TEST  | 1. Thermal shock Temperature : -45°C~ +55°C<br>2. Temperature change rate : 25°C / MIN<br>3. Dwell time low and high temperature : 30 MIN/EACH<br>4. Total test cycle : 10 CYCLE<br>5. Input/Output condition : 230VAC/Full Load AC ON/OFF TEST<br>turn on 58sec ; turn off 2sec |   | OK                | P       |
| 7  | VIBRATION TEST  | 1 Carton & 1 Set<br>(1) Waveform : Sine Wave<br>(2) Frequency : 10~500Hz<br>(3) Sweep Time : 12min/sweep cycle<br>(4) Acceleration : 2G<br>(5) Test Time : 72min in each axis (X.Y.Z)<br>(6) Ta : 25°C   |   | TEST : OK         | P       |



|    |                             |  |   |   |
|----|-----------------------------|--|---|---|
| 8  | CAPACITOR LIFE CYCLE        | LPF-16D-12:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT<br>(1) I/P : 230VAC O/P : FULL LOAD Ta=25 °C LIFE TIME<br>(2) I/P : 230VAC O/P : FULL LOAD Ta=50 °C LIFE TIME<br>(3) I/P : 230VAC O/P : 75% LOAD Ta=50 °C LIFE TIME | (1) 452611.8 HRS<br>(2) 91294.2 HRS<br>(3) 119635.2 HRS | P |
| 9  | MTBF                        | Conducted by Parts Stress Analysis Prediction<br>3572.8K hrs min. Telcordia SR-332 (Bellcore); 391.6K hrs min. MIL-HDBK-217F (25°C)  |   | P |
| 10 | DMTBF/Accelerated Life Test | Demonstration Mean Time Between Failure(Expected Life) :<br>50,000 hours @ Tcase70°C   |   | P |

| SAMPLE         | TEST RESULT | TESTER | APPROVAL |
|----------------|-------------|--------|----------|
| PRODUCT SAMPLE | PASS        | ZOULF  | HOWAY    |

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