



# Test Report: LPF-60-20

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60W 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°C	V1 : 21.6 mVp-p (Max)	P
2	CONSTANT CURRENT REGION	V1= 12V~20V	I/P : 230VAC O/P : CV MODE Ta : 25°C	O/P= 12V : 3.16 A O/P= 19V : 3.16 A	P
3	OUTPUT VOLTAGE TOLERANCE	V1 : 4 %~ -4 % (Max)	I/P : 100 VAC / 305 VAC O/P : FULL/ MIN LOAD Ta : 25°C	V1 : 0.3 %~ -0.3 %	P
4	LINE REGULATION	V1 : 0.5 %~ -0.5 % (Max)	I/P : 100 VAC ~ 305 VAC O/P : FULL LOAD Ta : 25°C	V1 : 0 %~ 0 %	P
5	LOAD REGULATION	V1 : 1 %~ -1 % (Max)	I/P : 230 VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.3 %~ -0.3 %	P
6	SET UP TIME	230VAC : 500 ms (Max) 115VAC : 1000 ms(Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 284 ms 115VAC/ 310 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°C	230VAC/ 12 ms 115VAC/ 13 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°C	230VAC/ 61 ms 115VAC/ 32 ms	P
9	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %	P
10	DYNAMIC LOAD	V1 : 2000 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°C	(1)373 mVp-p (2)319 mVp-p	P

**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°C  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 )	76 V~305V  TEST : OK	P
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P : 100 VAC ~ 305 VAC O/P : FULL~MIN LOAD Ta : 25°C	TEST : OK	P
3	POWER FACTOR	0.95 / 230 VAC(TYP) 0.98 / 115 VAC(TYP) 0.92 / 277VAC(TYP)	I/P : 230 VAC I/P : 115 VAC I/P : 277 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.980 / 100% PF= 0.998 / 100% PF= 0.93 / 100%	P
4	EFFICIENCY	88% (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	90.38 %	P
5	INPUT CURRENT	230V/ 0.4 A (TYP) 115V/ 0.8 A (TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I= 0.29 A/ 230 VAC I= 0.58 A/ 115 VAC	P
6	INRUSH CURRENT	230V/ 55 A (TYP) COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I= 45 A/ 230 VAC	P
7	LEAKAGE CURRENT	< 0.75 mA / 240 VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-CASE : 0.01 mA N-CASE : 0.01 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°C	105 %/ 230 VAC 105 %/ 115 VAC Constant Current Limiting ,recovers automatically after fault condition is removed.	P
2	OVER VOLTAGE PROTECTION	CH1 : 23 V ~ 27 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	25.31 V/ 230 VAC 25.43 V/ 115 VAC Shut down and latch off o/p voltage, re-power on to recover	P
3	OVER TEMPERATURE PROTECTION	SPEC : RTH2 : 90± 10°C O.T.P. NO DAMAGE	I/P : 230 VAC O/P : FULL LOAD	O.T.P. Active Shut down o/p voltage, re-power on to recover	P
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P : 305 VAC O/P : FULL LOAD Ta : 25°C	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	Q 3 Rated : 2SK3673-01MR 10A/700V	I/P : High-Line +3V = 308 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 632 V (2) 516 V (3) 628 V	P
2	Diode Peak Voltage	D101 Rated : STPS30M100ST 30A/100V	I/P : High-Line +3V = 308 V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C	(1) 96 V (2) 93.2 V (3) 93 V	P
4	Input Capacitor Voltage	C5 Rated : 47u/450V 105°C 16*25 KXJ	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°C	(1) 422.86 V (2) 420.93 V (3) 421.41 V	P
5	Control IC Voltage Test	U 1 Rated : PFC FAN6921MR 17V~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°C	(1) 22.145 V (2) 20.801 V (3) 20.796 V	P
6	Power Transistor ( D to S) or (C to E) Peak Voltage	Q1 Rated : STP11NK50ZFP 10A/500V	I/P : High-Line +3V = 308 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 454 V (2) 440 V (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 : 3.75KVAC/min	I/P-O/P : 4 KVAC/min Ta : 25°C	I/P-O/P : 2.474 mA  NO DAMAGE	P
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ	I/P-O/P : 500 VDC Ta : 25°C/70%RH	I/P-O/P : 30 GΩ  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%,60%LOAD CLASS C $\geq$ 60% Ta:25°C	PASS	P
2	CONDUCTION	EN55015 CLASS B	I/P: 230 VAC (50HZ)/115V[60HZ] O/P:FULL/60% LOAD Ta:25°C	PASS Test by certified Lab	P
3	RADIATION	EN55015 CLASS B	I/P: 230 VAC (50HZ)/115V[60HZ] O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab	P
4	E.S.D	AIR:8KV / Contact:6KV INDUSTRY	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A	P
5	E.F.T	EN61000-4-4 INDUSTRY INPUT: 2KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A	P
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV	I/P: 230 VAC/50HZ O/P:FULL LOAD 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-60-12 1. ROOM AMBIENT BURN-IN : 4 HRS I/P : 230VAC O/P : 95%LOAD Ta=28.3℃ 2. HIGH AMBIENT BURN-IN : 2.5 HRS I/P : 230VAC O/P : 95% LOAD Ta=54.1℃			P																																																																																										
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>P/N</th> <th>ROOM AMBIENT Ta=28.3 °C</th> <th>HIGH AMBIENT Ta= 54.1 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>L1</td><td>TR853A</td><td>51.8℃</td><td>75.5℃</td></tr> <tr><td>2</td><td>BD1</td><td>4A/800V SILICON UR4KB80</td><td>50.4℃</td><td>74.2℃</td></tr> <tr><td>3</td><td>Q1</td><td>STP11NK50ZFP 10A/500V</td><td>56.9℃</td><td>80.2℃</td></tr> <tr><td>4</td><td>D2</td><td>2A/800V GP20K</td><td>70.2℃</td><td>94.3℃</td></tr> <tr><td>5</td><td>Q3</td><td>2SK3673-01MR 10A/700V</td><td>70.5℃</td><td>94.2℃</td></tr> <tr><td>6</td><td>C16</td><td>22u/50V UL10Kh 5*11 YXM</td><td>61.2℃</td><td>84.7℃</td></tr> <tr><td>7</td><td>U1</td><td>PFC FAN6921MR</td><td>62.2℃</td><td>86.1℃</td></tr> <tr><td>8</td><td>C201</td><td>47u/50V UL10Kh 6.3*11 YXM</td><td>67.8℃</td><td>91.6℃</td></tr> <tr><td>9</td><td>RTH2</td><td>NTC 100KΩ 3Φ TTC3A104F4193EY 1%</td><td>59.5℃</td><td>82.9℃</td></tr> <tr><td>10</td><td>C5</td><td>47u/450V 105℃ 16*25 KXJ</td><td>58.3℃</td><td>81.5℃</td></tr> <tr><td>11</td><td>C105</td><td>820u/25V UL10Kh 10*20 ZLH</td><td>72.4℃</td><td>96.9℃</td></tr> <tr><td>13</td><td>D101</td><td>PFR30L60CT 30A/60V</td><td>75.7℃</td><td>100.7℃</td></tr> <tr><td>14</td><td>C111</td><td>330u/25V UL8Kh 8*11.5 ZLH</td><td>68.6℃</td><td>92.7℃</td></tr> <tr><td>15</td><td>LF100</td><td>TR895-R2</td><td>68.4℃</td><td>92.8℃</td></tr> <tr><td>16</td><td>D1</td><td>MUR460 4A/600V</td><td>58.8℃</td><td>82.0℃</td></tr> <tr><td>17</td><td>LF1</td><td>TR732A-R1</td><td>40.3℃</td><td>64.1℃</td></tr> <tr><td>18</td><td>T1</td><td>TF2222</td><td>53.6℃</td><td>77.5℃</td></tr> </tbody> </table>	NO	Position		P/N	ROOM AMBIENT Ta=28.3 °C	HIGH AMBIENT Ta= 54.1 °C	1	L1	TR853A	51.8℃	75.5℃	2	BD1	4A/800V SILICON UR4KB80	50.4℃	74.2℃	3	Q1	STP11NK50ZFP 10A/500V	56.9℃	80.2℃	4	D2	2A/800V GP20K	70.2℃	94.3℃	5	Q3	2SK3673-01MR 10A/700V	70.5℃	94.2℃	6	C16	22u/50V UL10Kh 5*11 YXM	61.2℃	84.7℃	7	U1	PFC FAN6921MR	62.2℃	86.1℃	8	C201	47u/50V UL10Kh 6.3*11 YXM	67.8℃	91.6℃	9	RTH2	NTC 100KΩ 3Φ TTC3A104F4193EY 1%	59.5℃	82.9℃	10	C5	47u/450V 105℃ 16*25 KXJ	58.3℃	81.5℃	11	C105	820u/25V UL10Kh 10*20 ZLH	72.4℃	96.9℃	13	D101	PFR30L60CT 30A/60V	75.7℃	100.7℃	14	C111	330u/25V UL8Kh 8*11.5 ZLH	68.6℃	92.7℃	15	LF100	TR895-R2	68.4℃	92.8℃	16	D1	MUR460 4A/600V	58.8℃	82.0℃	17	LF1	TR732A-R1	40.3℃	64.1℃	18	T1	TF2222	53.6℃	77.5℃		
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 95 % LOAD Ta= -30 °C	TEST : OK	P																																																																																										
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE	I/P : 305 VAC O/P : 95% LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK	P																																																																																										
4	TEMPERATURE COEFFICIENT	± 0.03 %(0~50℃)	I/P : 230 VAC O/P : 95% LOAD	± 0.01 %(0~50℃)	P																																																																																										
5	STORAGE TEMPERATURE TEST	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		OK	P																																																																																										
6	THERMAL SHOCK TEST	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 : 10 CYCLE 5. Input/Output condition : 230VAC/Full Load AC ON/OFF TEST turn on 58sec : turn off 2sec		OK	P																																																																																										

7	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 5G (5) Test Time : 72min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK	P
8	CAPACITOR LIFE CYCLE	LPF-60-12: SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta=25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta=50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME	(1) 125577 HRS (2) 24302 HRS (3) 41094 HRS	P
9	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE : 440.5 HRS		P
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 30,000 hours @ Tcase 80°C; 50,000 hours @ Tcase70°C		P

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2010/11/11	RD SAMPLE	PASS	SANFORD SU	VINCENT TSENG
2010/11/25	PRODUCT SAMPLE	PASS	SANFORD SU	VINCENT TSENG

2009/08/04 A50-F023