



# Test Report: HLP-60H-24

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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
1	RIPPLE & NOISE	V1 : 150 mVp-p (Max)	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	V1 : 15.6 mVp-p (Max)
2	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 22 V ~ 27 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	21.461 V ~ 28.075 V / 230 VAC 21.468 V ~ 28.075 V / 115 VAC
3	CURRENT ADJUST RANGE	CH1 : 1.5A ~ 2.5A	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	1.384 A ~ 2.715 A / 230 VAC 1.384 A ~ 2.711 A / 115 VAC
4	OUTPUT VOLTAGE TOLERANCE	V1 : 1 % ~ -1 % (Max)	I/P : 100 VAC / 305VAC O/P : FULL / MIN LOAD Ta : 25°C	V1 : 0.21 % ~ -0.21 %
5	LINE REGULATION	V1 : 0.5 % ~ -0.5 % (Max)	I/P : 100VAC ~ 305VAC O/P : FULL LOAD Ta : 25°C	V1 : 0.05 % ~ -0.05 %
6	LOAD REGULATION	V1 : 0.5 % ~ -0.5 % (Max)	I/P : 230 VAC O/P : FULL ~ MIN LOAD Ta : 25°C	V1 : 0.21 % ~ -0.21 %
7	SET UP TIME	230VAC : 500 ms (Max) 115VAC : 500 ms(Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC / 356 ms 115VAC / 303 ms
8	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 / 15 ms 115VAC / 16 ms
9	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 / 76 ms 115VAC / 41 ms
10	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %
11	DYNAMIC LOAD	V1 : 2400 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)146 mVp-p (2)1341 mVp-p

12	DIMMER TEST	SPEC:										
		*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
Output current	0.223A		0.480A	0.748A	1.011A	1.274A	1.546A	1.800A	2.008A	2.364A	2.502A	
%	8.92%		19.20%	29.92%	40.44%	50.96%	61.84%	72.00%	80.32%	94.56%	100.08%	
2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	
	Output current	0.222A	0.480A	0.734A	0.991A	1.247A	1.504A	1.762A	2.016A	2.273A	2.503A	
	%	8.88%	19.20%	29.36%	39.64%	49.88%	60.16%	70.48%	80.64%	90.92%	100.12%	
3	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
	Output current	0.291A	0.576A	0.841A	1.099A	1.347A	1.586A	1.817A	2.044A	2.271A	2.493A	
	%	11.64%	23.04%	33.64%	43.96%	53.88%	63.44%	72.68%	81.76%	90.84%	99.72%	

## INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~305 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	71 V~305V
			I/P : LOW-LINE-3V= 87 V HIGH-LINE+10V=315 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	I/P : 90 VAC ~ 305 VAC O/P : FULL -MIN LOAD Ta : 25°C	TEST : OK
3	POWER FACTOR	0.95 / 230 VAC(TYP) 0.98 / 115 VAC(TYP) 0.92 / 277 VAC(TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.968 / 230 VAC PF= 0.998 / 115 VAC PF= 0.9361 / 277 VAC
4	EFFICIENCY	89.5% (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	89.71 %
5	INPUT CURRENT	277V/ 0.3 A (TYP) 230V/ 0.32 A (TYP) 115V/ 0.64 A (TYP)	I/P : 277 VAC I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 0.256 A/ 277 VAC I = 0.30 A/ 230 VAC I = 0.589 A/ 115 VAC
6	INRUSH CURRENT	230V/ 55 A (TYP)  COLD START	I/P : 230 VAC  O/P : FULL LOAD Ta : 25°C	I = 54 A/ 230 VAC
7	LEAKAGE CURRENT	< 0.75 mA / 277 VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.22 mA N-FG : 0.20 mA

**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
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
2	OVER VOLTAGE PROTECTION	CH1 : 28 V ~ 35 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	30.43 V/ 230 VAC 30.10 V/ 115 VAC Shut down o/p voltage, re-power on to recover
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P : 230 VAC O/P : FULL LOAD	O.T.P. Active Shut down o/p voltage, re-power on to recover
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P : 305 VAC O/P : FULL LOAD Ta : 25°C	NO DAMAGE HICCUP

**COMPONENT STRESS TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	Power Transistor ( D to S) or (C to E) Peak Voltage	Q 1 Rated : 10A/600V	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) 512 V (2) 496 V (3) 492 V
2	Diode Peak Voltage	D101 Rated : 30A/150V	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) 110 V (2) 106 V (3) 108 V
3	Clamp Diode Peak Voltage	D2 Rated : 2A/800V	I/P : High-Line +3V = 308 V O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25°C	(1) 628 V (2) 632 V
4	Input Capacitor Voltage	C 5 Rated : 47u/450V	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) 432.22 V (2) 436.68 V (3) 434.85 V
5	Control IC Voltage Test	U1 Rated : 11V~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) 21.598 V (2) 21.492 V (3) 21.495 V
6	Power Transistor ( D to S) or (C to E) Peak Voltage	Q3 Rated : 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) 676 V (2) 548 V (3) 688 V

■ SAFETY & E.M.C. TEST

**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P : 3.75 KVAC/min I/P-FG : 2 KVAC/min<4.5mA O/P-FG : 1.5 KVAC/min	I/P-O/P : 4 KVAC/min I/P-FG : 2.4 KVAC/min O/P-FG : 1.8 KVAC/min Ta : 25°C	I/P-O/P : 2.343 mA I/P-FG : 2.426 mA O/P-FG : 0.527 mA 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°C /70%RH	I/P-O/P : 30 GΩ I/P-FG : 30 GΩ O/P-FG : 30 GΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C / 70%RH	9 mΩ

**E.M.C TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A CLASS C	I/P: 230VAC/50HZ O/P:100/90/80/70/60% ELECTRONICLOAD O/P:100%LED LOAD Ta:25°C	PASS
2	CONDUCTION	EN55022 EN55015 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL/60% LOAD Ta:25°C	PASS Test by certified Lab
3	RADIATION	EN55022 EN55015 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 INDUSTRY AIR:8KV / Contact:4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT: 2KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV L,N-PE:4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																								
1	TEMPERATURE RISE TEST	MODEL : HLP-60H-24 1. ROOM AMBIENT BURN-IN : 14 HRS I/P : 230VAC O/P : 95% LOAD Ta= 27.6℃ 2. HIGH AMBIENT BURN-IN : 2.5 HRS I/P : 230VAC O/P : 95% LOAD Ta= 56.4℃	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=27.6℃</th> <th>HIGH AMBIENT Ta=56.4℃</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>60.4℃</td><td>87.0℃</td></tr> <tr><td>2</td><td>LF2</td><td>50.0℃</td><td>74.6℃</td></tr> <tr><td>3</td><td>L1</td><td>51.9℃</td><td>76.5℃</td></tr> <tr><td>4</td><td>C10</td><td>53.3℃</td><td>79.5℃</td></tr> <tr><td>5</td><td>Q1</td><td>60.6℃</td><td>88.0℃</td></tr> <tr><td>6</td><td>Q3</td><td>65.7℃</td><td>93.4℃</td></tr> <tr><td>7</td><td>U1</td><td>56.6℃</td><td>82.3℃</td></tr> <tr><td>8</td><td>RTH2</td><td>47.5℃</td><td>72.6℃</td></tr> <tr><td>9</td><td>C5</td><td>49.0℃</td><td>73.8℃</td></tr> <tr><td>10</td><td>T1</td><td>70.9℃</td><td>97.9℃</td></tr> <tr><td>11</td><td>D101</td><td>74.5℃</td><td>102.1℃</td></tr> <tr><td>12</td><td>C106</td><td>59.8℃</td><td>85.9℃</td></tr> <tr><td>13</td><td>LF100</td><td>51.0℃</td><td>76.9℃</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=27.6℃	HIGH AMBIENT Ta=56.4℃	1	BD1	60.4℃	87.0℃	2	LF2	50.0℃	74.6℃	3	L1	51.9℃	76.5℃	4	C10	53.3℃	79.5℃	5	Q1	60.6℃	88.0℃	6	Q3	65.7℃	93.4℃	7	U1	56.6℃	82.3℃	8	RTH2	47.5℃	72.6℃	9	C5	49.0℃	73.8℃	10	T1	70.9℃	97.9℃	11	D101	74.5℃	102.1℃	12	C106	59.8℃	85.9℃	13	LF100	51.0℃	76.9℃	
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 95% LOAD Ta= -40℃ / -25℃	TEST : OK																																																								
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																																																								
4	TEMPERATURE COEFFICIENT	± 0.03 % (0-50℃)	I/P : 230 VAC O/P : 95% LOAD	± 0.006 % (0-50℃)																																																								
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																																																								
6	THERMAL SHOCK TEST	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		OK																																																								



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°C	TEST : OK
8	CAPACITOR LIFE CYCLE	HLP-60H-24 :SUPPOSE C106 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 (4) I/P : 230VAC O/P : 50% LOAD Ta= 50 °C LIFE TIME	(1) 218249 HRS (2) 93036 HRS (3) 131569 HRS (4) 205060 HRS
9	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE : 288.5K HRS	
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 30,000 hours @ TA 50°C	

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2011/5/3	PRODUCT SAMPLE	PASS	SANFORD SU	VINCENT TSENG

2009/08/04 A50-F023