



Test Report: HLP-60H-20

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 : 14.6 mVp-p (Max)
2	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 17 V ~ 22 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	16.586 V ~ 23.208 V / 230 VAC 16.659 V ~ 23.209 V / 115 VAC
3	CURRENT ADJUST RANGE	CH1 : 1.8A ~ 3 A	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	1.695 A ~ 3.271 A / 230 VAC 1.695 A ~ 3.271 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 : 0.41 %~ -0.41 %
5	LINE REGULATION	V1 : 0.5 %~ -0.5 % (Max)	I/P : 100VAC ~ 305VAC O/P : FULL LOAD Ta : 25°C	V1 : 0.03 %~ -0.03 %
6	LOAD REGULATION	V1 : 1 %~ -1 % (Max)	I/P : 230 VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.2 %~ -0.2 %
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/ 12 ms 115VAC/ 13 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/ 75 ms 115VAC/ 37 ms
10	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %
11	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)210 mVp-p (2)869 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	0.291A		0.592A	0.907A	1.206A	1.508A	1.831A	2.109A	2.409A	2.741A	3.013A	
%	9.70%		19.73%	30.23%	40.20%	50.27%	61.03%	70.30%	80.30%	91.37%	100.43%	
2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	
	Output current	0.290A	0.594A	0.896A	1.201A	1.506A	1.810A	2.114A	2.421A	2.725A	3.020A	
	%	9.67%	19.80%	29.87%	40.03%	50.20%	60.33%	70.47%	80.70%	90.83%	100.67%	
3	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
	Output current	0.369A	0.699A	1.016A	1.322A	1.616A	1.899A	2.175A	2.445A	2.716A	2.994A	
	%	12.30%	23.30%	33.87%	44.07%	53.87%	63.30%	72.50%	81.50%	90.53%	99.80%	

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	76 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)	I/P : 230 VAC	PF= 0.968 / 230 VAC
		0.98 / 115 VAC(TYP)	I/P : 115 VAC	PF= 0.998 / 115 VAC
		0.92 / 277 VAC(TYP)	I/P : 277 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.935 / 277 VAC
4	EFFICIENCY	89% (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	89.5 %
5	INPUT CURRENT	277V/ 0.3 A (TYP)	I/P : 277 VAC	I = 0.25 A/ 277 VAC
		230V/ 0.32 A (TYP)	I/P : 230 VAC	I = 0.30 A/ 230 VAC
		115V/ 0.64 A (TYP)	I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 0.59 A/ 115 VAC
6	INRUSH CURRENT	230V/ 55 A (TYP)	I/P : 230 VAC	I = 54 A/ 230 VAC
		COLD START	O/P : FULL LOAD Ta : 25°C	
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 : 0.22 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 : 23 V ~ 30 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	24.868 V/ 230 VAC 24.834 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) 488 V
2	Diode Peak Voltage	D101 Rated : 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) 93.2 V (2) 89.2 V (3) 89.2 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) 632 V (2) 636 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) 434.47 V (2) 434.50 V (3) 434.16 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) 21.678 V (2) 20.636 V (3) 20.651 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) 688 V (2) 564 V (3) 680 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 : 2.4KVAC/min O/P-FG : 1.8 KVAC/min Ta : 25°C	I/P-O/P : 1.804 mA I/P-FG : 2.360 mA O/P-FG : 0.464 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-15 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>63.0℃</td><td>88.4℃</td></tr> <tr><td>2</td><td>LF2</td><td>46.2℃</td><td>72.2℃</td></tr> <tr><td>3</td><td>L1</td><td>51.3℃</td><td>76.6℃</td></tr> <tr><td>4</td><td>C10</td><td>56.1℃</td><td>81.1℃</td></tr> <tr><td>5</td><td>Q1</td><td>65.3℃</td><td>90.1℃</td></tr> <tr><td>6</td><td>Q3</td><td>71.1℃</td><td>96.2℃</td></tr> <tr><td>7</td><td>U1</td><td>56.2℃</td><td>82.2℃</td></tr> <tr><td>8</td><td>RTH2</td><td>41.7℃</td><td>68.4℃</td></tr> <tr><td>9</td><td>C5</td><td>48.1℃</td><td>73.9℃</td></tr> <tr><td>10</td><td>T1</td><td>71.5℃</td><td>99.8℃</td></tr> <tr><td>11</td><td>D101</td><td>88.6℃</td><td>116.1℃</td></tr> <tr><td>12</td><td>C106</td><td>68.0℃</td><td>95.5℃</td></tr> <tr><td>13</td><td>LF100</td><td>63.0℃</td><td>86.0℃</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=27.6℃	HIGH AMBIENT Ta=56.4℃	1	BD1	63.0℃	88.4℃	2	LF2	46.2℃	72.2℃	3	L1	51.3℃	76.6℃	4	C10	56.1℃	81.1℃	5	Q1	65.3℃	90.1℃	6	Q3	71.1℃	96.2℃	7	U1	56.2℃	82.2℃	8	RTH2	41.7℃	68.4℃	9	C5	48.1℃	73.9℃	10	T1	71.5℃	99.8℃	11	D101	88.6℃	116.1℃	12	C106	68.0℃	95.5℃	13	LF100	63.0℃	86.0℃	
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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	± 0.03 % (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 : 3G (5) Test Time : 72min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK
8	CAPACITOR LIFE CYCLE	HLP-60H-15 :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) 172249 HRS (2) 66641 HRS (3) 104611 HRS (4) 202027 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