



Test Report: HLN-60H-15

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 : 11 mVp-p (Max)
2	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 13.5 V ~ 17 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	13.184 V ~ 17.561 V / 230 VAC 13.186 V ~ 17.566 V / 115 VAC
3	CURRENT ADJUST RANGE	CH1 : 2.4A ~ 4 A	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	2.164 A ~ 4.291 A / 230 VAC 2.163 A ~ 4.293 A / 115 VAC
4	OUTPUT VOLTAGE TOLERANCE	V1 : 2 % ~ -2 % (Max)	I/P : 100 VAC / 305VAC O/P : FULL / MIN LOAD Ta : 25°C	V1 : 0.5 % ~ -0.5 %
5	LINE REGULATION	V1 : 0.5 % ~ -0.5 % (Max)	I/P : 100VAC ~ 305VAC O/P : FULL LOAD Ta : 25°C	V1 : 0.04 % ~ -0.04 %
6	LOAD REGULATION	V1 : 1.5 % ~ -1.5 % (Max)	I/P : 230 VAC O/P : FULL ~ MIN LOAD Ta : 25°C	V1 : 0.5 % ~ -0.5 %
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/ 12 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/ 72 ms 115VAC/ 38 ms
10	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %
11	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°C	(1)234 mVp-p (2)758 mVp-p

12	DIMMER TEST (for B-type only)	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	0.432A		0.832A	1.257A	1.655A	2.062A	2.484A	2.872A	3.279A	3.730A	4.005A	
%	10.80%		20.80%	31.43%	41.38%	51.55%	62.10%	71.80%	81.98%	93.25%	100.13%	
2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	
	Output current	0.429A	0.836A	1.231A	1.633A	2.038A	2.436A	2.838A	3.242A	3.624A	4.008A	
	%	10.73%	20.90%	30.78%	40.83%	50.95%	60.90%	70.95%	81.05%	90.60%	100.20%	
3	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
	Output current	0.506A	0.928A	1.338A	1.733A	2.420A	2.498A	2.872A	3.241A	3.612A	3.984A	
	%	12.65%	23.20%	33.45%	43.33%	60.50%	62.45%	71.80%	81.03%	90.30%	99.60%	

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	73 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 /277VAC
4	EFFICIENCY	87% (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	87.35 %
5	INPUT CURRENT	277V/ 0.3 A (TYP)	I/P : 277 VAC	I = 0.262 A/ 277 VAC
		230V/ 0.32 A (TYP)	I/P : 230 VAC	I = 0.306 A/ 230 VAC
		115V/ 0.64 A (TYP)	I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 0.599 A/ 115 VAC
6	INRUSH CURRENT	230V/ 55 A (TYP)	I/P : 230 VAC	I = 53 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 : 18 V ~ 24 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	18.8V/ 230 VAC 18.7 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) 504 V (2) 494 V (3) 490 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) 65.2 V (2) 60.8 V (3) 64.4 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) 644 V (2) 640 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) 426.48 V (2) 438.81 V (3) 432.75 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) 21.724 V (2) 21.670 V (3) 21.681 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) 696 V (2) 584 V (3) 690 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 : 2.362 mA I/P-FG : 2.457 mA O/P-FG : 0.547 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 : HLN-60H-15 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : 95% LOAD Ta= 27.7℃ 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : 95% LOAD Ta= 40℃	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=27.7℃</th> <th>HIGH AMBIENT Ta=40℃</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>69.5℃</td><td>81.8℃</td></tr> <tr><td>2</td><td>LF2</td><td>59.4℃</td><td>71.1℃</td></tr> <tr><td>3</td><td>L1</td><td>62.9℃</td><td>75.2℃</td></tr> <tr><td>4</td><td>L3</td><td>60.3℃</td><td>72.6℃</td></tr> <tr><td>5</td><td>C10</td><td>64.2℃</td><td>76.5℃</td></tr> <tr><td>6</td><td>Q1</td><td>70.3℃</td><td>82.6℃</td></tr> <tr><td>7</td><td>Q3</td><td>74.7℃</td><td>87.0℃</td></tr> <tr><td>8</td><td>U1</td><td>63.6℃</td><td>75.9℃</td></tr> <tr><td>9</td><td>RTH2</td><td>60.1℃</td><td>72.4℃</td></tr> <tr><td>10</td><td>D2</td><td>79.2℃</td><td>91.5℃</td></tr> <tr><td>11</td><td>C5</td><td>64.6℃</td><td>76.7℃</td></tr> <tr><td>12</td><td>C16</td><td>62.3℃</td><td>74.6℃</td></tr> <tr><td>13</td><td>T1</td><td>78.6℃</td><td>90.9℃</td></tr> <tr><td>14</td><td>D101</td><td>82.6℃</td><td>94.9℃</td></tr> <tr><td>15</td><td>C106</td><td>73.0℃</td><td>85.3℃</td></tr> <tr><td>16</td><td>C203</td><td>59.6℃</td><td>71.9℃</td></tr> <tr><td>17</td><td>LF100</td><td>65.6℃</td><td>77.9℃</td></tr> <tr><td>18</td><td>C111</td><td>63.9℃</td><td>76.2℃</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=27.7℃	HIGH AMBIENT Ta=40℃	1	BD1	69.5℃	81.8℃	2	LF2	59.4℃	71.1℃	3	L1	62.9℃	75.2℃	4	L3	60.3℃	72.6℃	5	C10	64.2℃	76.5℃	6	Q1	70.3℃	82.6℃	7	Q3	74.7℃	87.0℃	8	U1	63.6℃	75.9℃	9	RTH2	60.1℃	72.4℃	10	D2	79.2℃	91.5℃	11	C5	64.6℃	76.7℃	12	C16	62.3℃	74.6℃	13	T1	78.6℃	90.9℃	14	D101	82.6℃	94.9℃	15	C106	73.0℃	85.3℃	16	C203	59.6℃	71.9℃	17	LF100	65.6℃	77.9℃	18	C111	63.9℃	76.2℃	
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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 40 ℃ NO DAMAGE	I/P : 305 VAC O/P : 95% LOAD Ta= 40 ℃ HUMIDITY= 95 %R.H	TEST : OK																																																																												
4	TEMPERATURE COEFFICIENT	± 0.03 % (0-40℃)	I/P : 230 VAC O/P : 95% LOAD	± 0.005 % (0-40℃)																																																																												
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℃~ +45℃ 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																																																																												



60W Single Output Switching Power Supply

HLN-60H series

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	HLN-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=40 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 40 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 40 °C LIFE TIME	(1) 122656 HRS (2) 43394 HRS (3) 101733 HRS (4) 179555 HRS
9	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE : 338K HRS	
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 30,000 hours @ Tcase 70°C · 50,000 hours @ Tcase 60°C	

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

2009/08/04 A50-F023