



# Test Report: HLG-60H-15

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60W Constant Voltage + Constant Current LED Driver

## ■ 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	CONSTANT CURRENT REGION	9V-15V	I/P : 230VAC O/P : CV=9V-14V Ta : 25°C	TEST : OK
2	RIPPLE & NOISE	V1 : 150 mVp-p (Max)	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	V1 : 11 mVp-p (Max)
3	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
4	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
5	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 %
6	LINE REGULATION	V1 : 0.5 % ~ -0.5 % (Max)	I/P : 100VAC ~ 305VAC O/P : FULL LOAD Ta : 25°C	V1 : 0.04 % ~ -0.04 %
7	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 %
8	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
9	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
10	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
11	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %
12	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

13	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	100K
			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)	O/P : FULL LOAD Ta : 25°C	PF= 0.9355 / 277 VAC
4	EFFICIENCY	87.5% (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	87.81 %
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
8	TOTAL HARMONIC DISTORTION	THD< 20% when output loading ≥ 60% at 115VAC/230VAC input and output loading ≥ 75% at 277VAC input	I/P : 115 VAC I/P : 230 VAC O/P : 60% LOAD	THD : 6.55 /115VAC THD : 15.1 /230VAC
			I/P : 277 VAC O/P : 75%LOAD Ta : 25°C	THD : 16.46 /277VAC

**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 mode, recovers automatically after fault condition is removed

**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 : 2.4KVAC/min O/P-FG : 1.8KVAC/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**

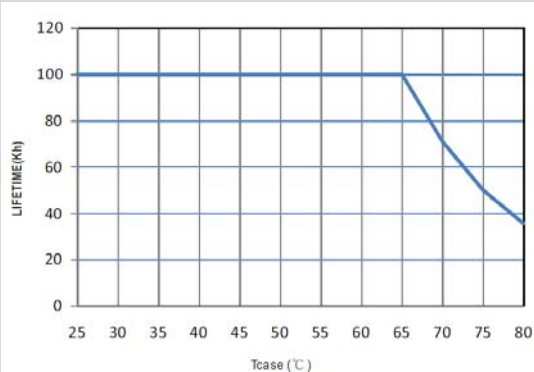
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS C	I/P: 230VA50HZ O/P:100% ELECTRONIC LOAD O/P:100%/LED LOAD Ta:25°C	PASS
2	CONDUCTION	EN55015 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL LOAD Ta:25°C	PASS Test by certified Lab
3	RADIATION	EN55015 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL 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 : HLG-60H-15 1. ROOM AMBIENT BURN-IN : 0.5 HRS I/P : 230VAC O/P : 95% LOAD Ta= 29.4℃ 2. HIGH AMBIENT BURN-IN : 18 HRS I/P : 230VAC O/P : 95% LOAD Ta= 67.6℃	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta= 29.4℃</th> <th>HIGH AMBIENT Ta=67.6℃</th> </tr> </thead> <tbody> <tr><td>1</td><td>BD1</td><td>52.6℃</td><td>86.1℃</td></tr> <tr><td>2</td><td>LF2</td><td>51.8℃</td><td>85.5℃</td></tr> <tr><td>3</td><td>L1</td><td>52.1℃</td><td>85.7℃</td></tr> <tr><td>4</td><td>L3</td><td>50.7℃</td><td>84.3℃</td></tr> <tr><td>5</td><td>C10</td><td>51.3℃</td><td>85.1℃</td></tr> <tr><td>6</td><td>Q1</td><td>54.0℃</td><td>88.0℃</td></tr> <tr><td>7</td><td>Q3</td><td>62.6℃</td><td>98.9℃</td></tr> <tr><td>8</td><td>U1</td><td>52.8℃</td><td>86.7℃</td></tr> <tr><td>9</td><td>RTH2</td><td>50.6℃</td><td>83.7℃</td></tr> <tr><td>10</td><td>D2</td><td>61.2℃</td><td>96.6℃</td></tr> <tr><td>11</td><td>C5</td><td>53.7℃</td><td>86.6℃</td></tr> <tr><td>12</td><td>C16</td><td>52.8℃</td><td>85.7℃</td></tr> <tr><td>13</td><td>T1</td><td>60.4℃</td><td>94.1℃</td></tr> <tr><td>14</td><td>D101</td><td>62.8℃</td><td>96.2℃</td></tr> <tr><td>15</td><td>C106</td><td>56.1℃</td><td>89.2℃</td></tr> <tr><td>16</td><td>C203</td><td>51.1℃</td><td>84.0℃</td></tr> <tr><td>17</td><td>LF100</td><td>55.3℃</td><td>88.3℃</td></tr> <tr><td>18</td><td>C111</td><td>53.1℃</td><td>86.1℃</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta= 29.4℃	HIGH AMBIENT Ta=67.6℃	1	BD1	52.6℃	86.1℃	2	LF2	51.8℃	85.5℃	3	L1	52.1℃	85.7℃	4	L3	50.7℃	84.3℃	5	C10	51.3℃	85.1℃	6	Q1	54.0℃	88.0℃	7	Q3	62.6℃	98.9℃	8	U1	52.8℃	86.7℃	9	RTH2	50.6℃	83.7℃	10	D2	61.2℃	96.6℃	11	C5	53.7℃	86.6℃	12	C16	52.8℃	85.7℃	13	T1	60.4℃	94.1℃	14	D101	62.8℃	96.2℃	15	C106	56.1℃	89.2℃	16	C203	51.1℃	84.0℃	17	LF100	55.3℃	88.3℃	18	C111	53.1℃	86.1℃	
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16	C203	51.1℃	84.0℃																																																																													
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18	C111	53.1℃	86.1℃																																																																													
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 60 ℃ NO DAMAGE	I/P : 305 VAC O/P : 95% LOAD Ta= 60 ℃ HUMIDITY= 95 %R.H	TEST : OK																																																																												
4	TEMPERATURE COEFFICIENT	±0.03 %(0-50℃)	I/P : 230 VAC O/P : 95% LOAD	± 0.002 %(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℃~ +65℃ 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 : 5G (5) Test Time : 72min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK
8	CAPACITOR LIFE CYCLE	HLG-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=60 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 60 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 60 °C LIFE TIME	(1) 494706 HRS (2) 62238 HRS (3) 95274 HRS (4) 133196 HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 1132K hrs min. Telcordia SR-332 (Bellcore) ; 338K hrs min. MIL-HDBK-217F (25°C)	
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 62,000 hours @ Tcase 70°C 	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT TSENG

2009/08/04 A50-F023