



Test Report: HLG-60H-C700

70W Constant Current Mode 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

■ **ESIGN VERIFY TEST**

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																														
1	CONSTANT CURRENT REGION	50V-100V	I/P : 230VAC O/P : CV MODE : 50V-99V Ta : 25°C	TEST : OK																																																																														
2	RIPPLE CURRENT	5.0% max. @rated current	I/P : 230VAC O/P : LED LOAD : 98V Ta : 25°C	3.14 %																																																																														
3	CURRENT ACCURACY	± 5%	I/P : 230VAC O/P : CV MODE : 50V-100V Ta : 25°C	± 3 %																																																																														
4	OUTPUT CURRENT ADJUST RANGE	CH1 : 420mA~ 700mA	I/P : 230VAC I/P : 115 VAC O/P : CV MODE : 98V Ta : 25°C	0.404 A~ 0.758 A/ 230VAC 0.404 A~ 0.758 A/ 115 VAC																																																																														
5	LINE REGULATION	V1: - 1% ~ 1 % (Max)	I/P:100 VAC ~305 VAC O/P:FULL LOAD Ta:25°C	V1:0.08%~-0.08%																																																																														
6	SET UP TIME	230 VAC : 500 ms (Max) 115VAC : 750 ms(Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230 VAC/ 310 ms 115 VAC/ 395 ms																																																																														
7	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %																																																																														
8	DIMMING TEST	<p>※Built-in 3 in 1 dimming function, IP67 rated. Output constant current level can be adjusted through output cable by connecting a resistance or 1 ~ 10Vdc or 10V PWM signal between DIM+ and DIM-.</p> <p>※ Please DO NOT connect "DIM-" to "-V".</p> <p>※Reference resistance value for output current adjustment (Typical)</p> <table border="1" style="width:100%; text-align:center;"> <tr> <td>Resistance value</td> <td>10K</td><td>20K</td><td>30K</td><td>40K</td><td>50K</td><td>60K</td><td>70K</td><td>80K</td><td>90K</td><td>100K</td> </tr> <tr> <td>Output current</td> <td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td> </tr> </table> <p>*1 ~ 10V dimming function for output current adjustment (Typical)</p> <table border="1" style="width:100%; text-align:center;"> <tr> <td>Dimming value</td> <td>1V</td><td>2V</td><td>3V</td><td>4V</td><td>5V</td><td>6V</td><td>7V</td><td>8V</td><td>9V</td><td>10V</td> </tr> <tr> <td>Output current</td> <td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td> </tr> </table> <p>*10V PWM signal for output current adjustment (Typical)</p> <table border="1" style="width:100%; text-align:center;"> <tr> <td>Duty value</td> <td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td> </tr> <tr> <td>Output current</td> <td>10%</td><td>20%</td><td>30%</td><td>40%</td><td>50%</td><td>60%</td><td>70%</td><td>80%</td><td>90%</td><td>100%</td> </tr> </table> <p>TEST RESULT: I/P : 230 VAC ;Ta : 25°C</p> <table border="1" style="width:100%; text-align:center;"> <tr> <td>1</td> <td>Resistance value</td> <td>10K</td><td>20K</td><td>30K</td><td>40K</td><td>50K</td><td>60K</td><td>70K</td><td>80K</td><td>90K</td><td>100K</td> </tr> </table>			Resistance value	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Output current	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	1	Resistance value	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K
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	1	Output current	0.070A	0.156A	0.218A	0.289A	0.363A	0.433A	0.502A	0.575A	0.637A	0.700A
		%	10%	22.29%	31.14%	41.29%	51.86%	61.86%	71.71%	82.14%	91.00%	100.00%
	2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V
		Output current	0.069A	0.142A	0.213A	0.285A	0.357A	0.428A	0.499A	0.571A	0.642A	0.709A
		%	9.86%	20.29%	30.43%	40.71%	51%	61.14%	71.29%	81.57%	91.71%	101.29%
		Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	3	Output current	0.078A	0.149A	0.220A	0.291A	0.362A	0.433A	0.503A	0.574A	0.643A	0.711A
		%	11.14%	21.29%	31.43%	41.57%	51.71%	61.86%	71.86%	82.00%	91.86%	101.57%
		Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

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 I/P : LOW-LINE-3V=87V HIGH-LINE+10V=315V O/P : FULL/MIN LOAD ON : 30 Sec. OFF : 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE)	68 V~305V TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE	I/P : 90VAC ~305 VAC O/P : FULL-MIN LOAD Ta : 25°C	TEST : OK
3	POWER FACTOR	0.98 / 115VAC(TYP) 0.96 /230 VAC(TYP) 0.94 /277 VAC(TYP)	I/P : 115VAC I/P : 230VAC I/P : 277VAC O/P : FULL LOAD Ta : 25°C	PF= 0.998 / 115VAC PF= 0.980 / 230VAC PF= 0.961 / 277VAC
4	EFFICIENCY	90.5 % (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	91.12 %
5	INPUT CURRENT	277V/ 0.29 A (TYP) 230V/ 0.35 A (TYP) 115V/ 0.69 A (TYP)	I/P : 277 VAC I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 0.284 A/ 277 VAC I = 0.336 A/ 230 VAC I = 0.673 A/ 115 VAC
6	INRUSH CURRENT	230V/ 60 A (TYP) (twidth=275us measured at 50% Ipeak) COLD START	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	I = 48 A/ 230VAC T50= 270 us
7	LEAKAGE CURRENT	< 0.75 mA/ 277 VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.38 mA N-FG : 0.30 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 I/P : 277 VAC O/P : 75%LOAD Ta : 25°C	THD : 9.15 /115VAC THD : 16.94 /230VAC THD : 18.48 /277VAC

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER VOLTAGE PROTECTION	CH1 : 120 V ~ 140 V	I/P : 115 VAC I/P : 230 VAC O/P : MIN LOAD Ta : 25°C	132.75 V/ 115VAC 133.05V/ 230 VAC Shut down o/p voltage with auto-recovery or re-power on to recovery
2	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 recovery
3	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	Q3 Rated : 8A/900V	I/P : High-Line +3V = 308V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 832 V (2) 556 V (3) 808 V
2	Diode Peak Voltage	D100 Rated : 3A/400V	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) 252 V (2) 190 V (3) 247 V
3	Input Capacitor Voltage	C5 Rated : 47u/450V	I/P : High-Line +3V = 308V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1) 450 V (2) 434 V (3) 446 V
4	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) 24.2 V (2) 27.6 V (3) 23.4 V
6	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : 10A/600V	I/P : High-Line +3V = 308V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 500 V (2) 458 V (3) 452 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 : 3.10 mA I/P-FG : 2.256 mA O/P-FG : 2.121 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	14 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS C	I/P: 230/347VAC/60HZ O/P:100%/60%:ELECTRONIC LOAD O/P:100% LED LOAD Ta:25°C	PASS
2	CONDUCTION	EN55015 CLASS B	I/P: 230VAC (50HZ) O/P:FULL/50% LOAD Ta:25°C	PASS Test by certified Lab
3	RADIATION	EN55015 CLASS B	I/P: 230/230 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:230/230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT: 2KV	I/P: 230/230 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: 230/230 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-C700 1. ROOM AMBIENT BURN-IN : 18 HRS I/P : 230VAC O/P : FULL LOAD Ta= 28 °C 2. HIGH AMBIENT BURN-IN : 0.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 53.7 °C	<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>ROOM AMBIENT Ta=28 °C</th> <th>HIGH AMBIENT Ta=53.7 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>48.2°C</td><td>67.2°C</td></tr> <tr><td>2</td><td>LF2</td><td>51.0°C</td><td>69.9°C</td></tr> <tr><td>3</td><td>BD1</td><td>52.3°C</td><td>71.4°C</td></tr> <tr><td>4</td><td>L1</td><td>52.8°C</td><td>71.6°C</td></tr> <tr><td>5</td><td>L3</td><td>53.4°C</td><td>72.3°C</td></tr> <tr><td>6</td><td>C11</td><td>52.8°C</td><td>71.8°C</td></tr> <tr><td>7</td><td>D3</td><td>54.2°C</td><td>73.0°C</td></tr> <tr><td>8</td><td>D1</td><td>54.6°C</td><td>73.6°C</td></tr> <tr><td>9</td><td>C5</td><td>53.2°C</td><td>72.0°C</td></tr> <tr><td>10</td><td>D2</td><td>61.6°C</td><td>81.2°C</td></tr> <tr><td>11</td><td>Q3</td><td>54.0°C</td><td>73.1°C</td></tr> <tr><td>12</td><td>Q1</td><td>52.5°C</td><td>71.6°C</td></tr> <tr><td>13</td><td>U1</td><td>57.0°C</td><td>76.2°C</td></tr> <tr><td>14</td><td>C18</td><td>56.7°C</td><td>75.3°C</td></tr> <tr><td>15</td><td>C16</td><td>53.7°C</td><td>72.4°C</td></tr> <tr><td>16</td><td>RTH2</td><td>52.4°C</td><td>71.3°C</td></tr> <tr><td>17</td><td>T1</td><td>64.0°C</td><td>82.6°C</td></tr> <tr><td>18</td><td>D100</td><td>56.8°C</td><td>75.6°C</td></tr> <tr><td>19</td><td>C201</td><td>56.3°C</td><td>74.8°C</td></tr> <tr><td>20</td><td>C203</td><td>54.1°C</td><td>72.8°C</td></tr> <tr><td>21</td><td>C105</td><td>57.1°C</td><td>75.7°C</td></tr> <tr><td>22</td><td>LF100</td><td>52.0°C</td><td>71.7°C</td></tr> <tr><td>23</td><td>C111</td><td>54.0°C</td><td>72.9°C</td></tr> </tbody> </table>	NO	Position	ROOM AMBIENT Ta=28 °C	HIGH AMBIENT Ta=53.7 °C	1	LF1	48.2°C	67.2°C	2	LF2	51.0°C	69.9°C	3	BD1	52.3°C	71.4°C	4	L1	52.8°C	71.6°C	5	L3	53.4°C	72.3°C	6	C11	52.8°C	71.8°C	7	D3	54.2°C	73.0°C	8	D1	54.6°C	73.6°C	9	C5	53.2°C	72.0°C	10	D2	61.6°C	81.2°C	11	Q3	54.0°C	73.1°C	12	Q1	52.5°C	71.6°C	13	U1	57.0°C	76.2°C	14	C18	56.7°C	75.3°C	15	C16	53.7°C	72.4°C	16	RTH2	52.4°C	71.3°C	17	T1	64.0°C	82.6°C	18	D100	56.8°C	75.6°C	19	C201	56.3°C	74.8°C	20	C203	54.1°C	72.8°C	21	C105	57.1°C	75.7°C	22	LF100	52.0°C	71.7°C	23	C111	54.0°C	72.9°C	
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 99% LOAD Ta : 25°C	TEST : OK																																																																																																
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 100 % LOAD Ta= -45 °C	TEST : OK																																																																																																
4	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 : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK																																																																																																
5	TEMPERATURE COEFFICIENT	± 0.03%(0-50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.004 %(0-50°C)																																																																																																



70W Constant Current Mode LED Driver

HLG-60H-C series

6	STORAGE TEMPERATURE TEST	<ol style="list-style-type: none"> 1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 5 CYCLE 5. Input/Output condition : STATIC 	OK																
7.	THERMAL SHOCK TEST	<ol style="list-style-type: none"> 1. Thermal shock Temperature : -45°C~ +55°C 2. Temperature change rate : 25°C / 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																
8	VIBRATION TEST	<p>1 Carton & 1 Set</p> <ol style="list-style-type: none"> (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																
9	CAPACITOR LIFE CYCLE	<p>HLG-60H-C700:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT</p> <ol style="list-style-type: none"> (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 	<ol style="list-style-type: none"> (1) 472419 HRS (2) 132876 HRS (3) 175577 HRS (4) 216634 HRS 																
10	MTBF	<p>Conducted by Parts Stress Analysis Prediction</p> <p>878.1K hrs min. Telcordia SR-332 (Bellcore) ; 338K hrs min. MIL-HDBK-217F (25°C)</p>																	
11	DMTBF/Accelerated Life Test	<p>Demonstration Mean Time Between Failure (Expected Life): Above 62,000 hours @ Tcase 75°C</p> <table border="1"> <caption>Graph Data</caption> <thead> <tr> <th>Tcase (C)</th> <th>LIFETIME(kh)</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>100</td> </tr> <tr> <td>30</td> <td>100</td> </tr> <tr> <td>40</td> <td>100</td> </tr> <tr> <td>50</td> <td>100</td> </tr> <tr> <td>60</td> <td>100</td> </tr> <tr> <td>70</td> <td>100</td> </tr> <tr> <td>80</td> <td>50</td> </tr> </tbody> </table>		Tcase (C)	LIFETIME(kh)	20	100	30	100	40	100	50	100	60	100	70	100	80	50
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TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	DANIEL GAO	SANFORD SU	VINCENT TSENG

2009/08/04 A50-F023