



# Test Report: HBG-160P-36

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160W 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	VERDICT
1	RIPPLE & NOISE	V1 : 300 mVp-p (Max)	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	V1 : 40 mVp-p (Max)	P
2	CONSTANT CURRENT REGION	CH1: 21.6V ~ 36V	I/P : 230VAC O/P : CV MODE Ta : 25°C	O/P= 21.6V : 4.516 A O/P= 36V : 4.547 A	P
3	CURRENT ADJUST RANGE	CH1: 2.6A ~ 4.4A	I/P : 230VAC I/P : 115VAC O/P : CV MODE Ta : 25°C	2.273 A ~ 4.803 A /230VAC 2.299 A ~ 4.809 A /115VAC	P
4	OUTPUT VOLTAGE TOLERANCE	V1 : 2%~ -2% (Max)	I/P : 100 VAC / 305 VAC O/P : FULL/ MIN LOAD Ta : 25°C	V1 : 0.850 %~ -0.105 %	P
5	LINE REGULATION	V1 : 0.5%~ -0.5% (Max)	I/P : 100 VAC ~ 305 VAC O/P : FULL LOAD Ta : 25°C	V1 : 0.017 %~ 0 %	P
6	LOAD REGULATION	V1 : 1%~ -1% (Max)	I/P : 230 VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.041 %~ -0.051 %	P
7	SET UP TIME	230VAC : 500 ms (Max) 115VAC : 2500 ms(Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 229.848 ms 115VAC/ 420.686 ms	P
8	RISE TIME	230VAC : 200 ms (Max) 115VAC : 200 ms (Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 31.77 ms 115VAC/ 31.44 ms	P
9	HOLD UP TIME	230VAC : 12 ms (TYP) 115VAC : 12 ms (TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 21.34 ms 115VAC/ 21.37 ms	P
10	OVER/UNDERSHOOT TEST	<±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %	P
11	DYNAMIC LOAD	V1 : 3600 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) 468 mVp-p (2) 716 mVp-p	P

12	DIMMING TEST (B-TYPE)	<p>SPEC: *Output constant current level can be adjusted by applying one of the three methodologies between DIM+ and DIM-: 1 ~ 10Vdc, or 10V PWM signal or resistance.</p> <p>*Reference resistance value for output current adjustment (Typical)</p> <table border="1" data-bbox="311 392 1364 504"> <tr> <th>Resistance value</th> <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> <th>Output current</th> <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" data-bbox="311 537 1364 649"> <tr> <th>Dimming value</th> <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> <th>Output current</th> <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) Frequency range : 100Hz~3KHz</p> <table border="1" data-bbox="311 683 1364 817"> <tr> <th>Duty value</th> <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> <th>Output current</th> <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" data-bbox="311 884 1396 1433"> <tr> <td rowspan="3">1</td> <th>Resistance value</th> <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> <th>Output current</th> <td>0.498A</td><td>0.929A</td><td>1.360A</td><td>1.790A</td><td>2.217A</td><td>2.636A</td><td>3.056A</td><td>3.477A</td><td>3.898A</td><td>4.319A</td> </tr> <tr> <th>%</th> <td>11.32%</td><td>21.11%</td><td>30.91%</td><td>40.68%</td><td>50.39%</td><td>59.91%</td><td>69.45%</td><td>79.02%</td><td>88.59%</td><td>98.16%</td> </tr> <tr> <td rowspan="3">2</td> <th>Dimming value</th> <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> <th>Output current</th> <td>0.489A</td><td>0.917A</td><td>1.349A</td><td>1.781A</td><td>2.208A</td><td>2.630A</td><td>3.504A</td><td>3.480A</td><td>3.901A</td><td>4.332A</td> </tr> <tr> <th>%</th> <td>11.11%</td><td>20.84%</td><td>30.66%</td><td>40.48%</td><td>50.18%</td><td>59.77%</td><td>79.64%</td><td>79.09%</td><td>88.66%</td><td>98.45%</td> </tr> <tr> <td rowspan="3">3</td> <th>Duty value</th> <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> <th>Output current</th> <td>0.527A</td><td>0.955A</td><td>1.386A</td><td>1.812A</td><td>2.241A</td><td>2.657A</td><td>3.077A</td><td>3.501A</td><td>3.921A</td><td>4.304A</td> </tr> <tr> <th>%</th> <td>11.91%</td><td>21.68%</td><td>31.50%</td><td>41.16%</td><td>50.89%</td><td>60.39%</td><td>69.91%</td><td>79.55%</td><td>89.14%</td><td>97.82%</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	Output current	0.498A	0.929A	1.360A	1.790A	2.217A	2.636A	3.056A	3.477A	3.898A	4.319A	%	11.32%	21.11%	30.91%	40.68%	50.39%	59.91%	69.45%	79.02%	88.59%	98.16%	2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	Output current	0.489A	0.917A	1.349A	1.781A	2.208A	2.630A	3.504A	3.480A	3.901A	4.332A	%	11.11%	20.84%	30.66%	40.48%	50.18%	59.77%	79.64%	79.09%	88.66%	98.45%	3	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	Output current	0.527A	0.955A	1.386A	1.812A	2.241A	2.657A	3.077A	3.501A	3.921A	4.304A	%	11.91%	21.68%	31.50%	41.16%	50.89%	60.39%	69.91%	79.55%	89.14%	97.82%	P
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9	DALI DIMMING OPERATION (primary side :for DA-Type)	<p>※DALI Interface          ·Apply DALI signal between DA+ and DA-.          ·DALI protocol comprises 16 groups and 64 addresses.          ·First step is fixed at 8% of output.</p> <p>I/P : 230 VAC          O/P : DIMMING TEST          Ta : 25°C          TEST RESULT : OK</p>																																																																																																																																																																									

**INPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	90VAC~305 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	87 V~305V	P
			I/P : LOW-LINE-3V=87 V HIGH-LINE=305 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 OSC	I/P : 90 VAC ~ 305 VAC O/P : FULL~MIN LOAD Ta : 25°C	TEST : OK	P
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 I/P : 277 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.974 / 230 VAC PF= 0.997 / 115 VAC PF= 0.953 / 277 VAC	P
4	EFFICIENCY	92% (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	93.08 %	P
5	INPUT CURRENT	230V/ 0.78 A (TYP) 115V/ 1.70 A (TYP) 277V/ 0.70 A (TYP)	I/P : 230 VAC I/P : 115 VAC I/P : 277 VAC O/P : FULL LOAD Ta : 25°C	I = 0.776 A/ 230 VAC I = 1.549 A/ 115 VAC I = 0.658 A/ 277 VAC	P
6	INRUSH CURRENT	230V/ 65 A (TYP) COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I = 55.22 A/ 230 VAC	P
7	LEAKAGE CURRENT	< 0.75 mA / 277 VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-CASE : 0.3473 mA N-CASE : 0.3351 mA	P
8	TOTAL HARMONIC DISTORTION	Total harmonic distortion will be lower than 20% when output loading is 60% or higher at 115VAC/230VAC	I/P : 115VAC I/P : 230VAC O/P : 60% LOAD	THD : 8.53 %/115VAC THD : 12.58 %/230VAC	P
		Total harmonic distortion will be lower than 20% when output loading is 75% or higher at 277VAC	I/P : 277VAC O/P : 75% LOAD	THD : 13.75 %/277VAC	

**PROTECTION FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	95 % ~ 108 %	I/P : 230 VAC I/P : 115 VAC O/P : TESTING Ta : 25°C	100.68 %/ 230 VAC 100.66 %/ 115 VAC Constant current limiting, recovers automatically after fault condition is removed.	P
2	OVER VOLTAGE PROTECTION	CH1 : 41 V ~ 47 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	43.8 V/ 230 VAC 43.8 V/ 115 VAC Shut down o/p voltage with auto-recovery or re-power on to recover	P
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P : 230 VAC O/P : FULL LOAD	O.T.P. Active Shut down o/p voltage, recovers automatically after temperature goes down	P
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.	P

**COMPONENT STRESS TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor ( D to S) or (C to E) Peak Voltage	Q6 Rated : 600V/11A	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) 480 V (2) 434 V (3) 440 V	P
2	Diode Peak Voltage	D100 Rated : 100V/40A	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) 81.6 V (2) 12.7 V (3) 81.2 V	P
3	Input Capacitor Voltage	C5 Rated : 82u/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) 448 V (2) 440 V (3) 442 V	P
4	Control IC Voltage Test	U 2 Rated : 16V (MAX)	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) 14.0 V (2) 14.3 V (3) 14.0 V	P
5	Power Transistor ( D to S) or (C to E) Peak Voltage	Q1 Rated : 600V/16A	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) 480 V (2) 458 V (3) 452 V	P

■ SAFETY & E.M.C. TEST

**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P : 3.75 KVAC/min I/P-FG : 2.0 KVAC/min O/P-FG : 0.5 KVAC/min	I/P-O/P : 4.2 KVAC/min I/P-FG : 2.4 KVAC/min O/P-FG : 0.6 KVAC/min Ta : 25°C	I/P-O/P : 2.985 mA I/P-FG : 2.596 mA O/P-FG : 3.598 mA NO DAMAGE	P
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 : >9999 MΩ I/P-FG : >9999 MΩ O/P-FG : >9999 MΩ NO DAMAGE	P

**E.M.C TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS C	I/P:220VAC/230VAC/240VAC50HZ O/P:100%,75%,60%LOAD Ta:25°C	PASS	P
2	CONDUCTION	EN55015	I/P: 230 VAC (50HZ)/115V[60HZ] O/P:FULL/65% LOAD Ta:25°C	PASS Test by certified Lab	P
3	RADIATION	EN55015	I/P: 230 VAC (50HZ)/115V[60HZ] O/P: FULL/65% LOAD Ta:25°C	PASS Test by certified Lab	P
4	E.S.D	EN61000-4-2 LIGHT INDUSTRY AIR:8KV / Contact:4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A	P
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 1KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A	P
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV L,N-EARTH:4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25°C	CRITERIA A	P
7	Test by certified Lab & Test Report Prepare				

■ **RELIABILITY TEST**

**ENVIRONMENT TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	TEMPERATURE RISE TEST	MODEL : HBG-160P-36 1. ROOM AMBIENT BURN-IN : 1.0 HRS I/P : 230VAC O/P : 95% LOAD Ta=31.3 °C 2. HIGH AMBIENT BURN-IN : 2.0 HRS I/P : 230VAC O/P : 95% LOAD Ta=48.3 °C			P
2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 95 % LOAD Ta= -45/-35°C	TEST : OK	P
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45°C NO DAMAGE	I/P : 305 VAC O/P : 95% LOAD Ta= 45 °C HUMIDITY= 95 %R.H	TEST : OK	P
4	TEMPERATURE COEFFICIEN	±0.03 %(0~45°C)	I/P : 230 VAC O/P : 95% LOAD	±0.003 %(0~45°C)	P
5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -45°C~ +85°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	P
6	THERMAL SHOCK TEST	1. Thermal shock Temperature : -45°C~ +50°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	P

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	P
8	CAPACITOR LIFE CYCLE	HBG-160P-36:SUPPOSE C102 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=45 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta=45 °C LIFE TIME	(1) 346998 HRS (2) 148988 HRS (3) 203764 HRS	P
9	MTBF	Conducted by Parts Stress Analysis Prediction 2612.1K hrs min. Telcordia SR-332 (Bellcore) ; 195.6K hrs min. MIL-HDBK-217F (25°C)		P
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Ta 45°C		P

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	ZHANGZJ/ZHOUB	SKY	LIUWY

2009/08/04 A50-G058