



# Test Report: HBG-200-36

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200W 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

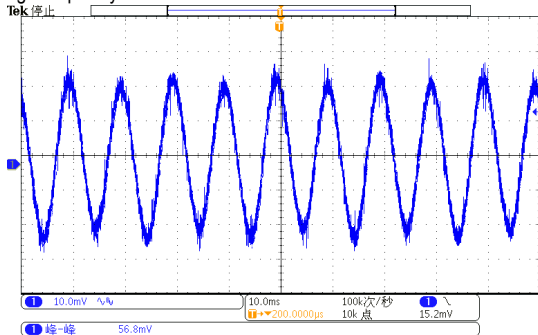
Environment Test

## DESIGN VERIFY TEST

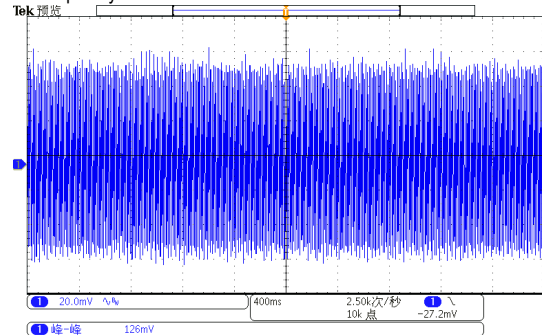
### OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONSTANT CURRENT REGION	21.6 V~ 36 V	I/P: 230VAC O/P: LED MODE Ta: 25°C	18.24V~ 36.00 V
2	OUTPUT CURRENT ADJUST RANGE (For A-Type And AB-Type)	3.3A~5.5A	I/P: 230VAC O/P: SETING Ta: 25°C	1.91A~6.23A
3	OUTPUT VOLTAGE TOLERANCE	-2%~+2%	I/P: 90VAC / 305VAC O/P: FULL/60%/ NO LOAD Ta: 25°C	-0.78%~ 1.11%
4	LINE REGULATION	-0.5%~+0.5%	I/P: 90VAC ~ 305VAC O/P: 60% ~ FULL LOAD Ta: 25°C	-0.28%~ 0.28%
5	LOAD REGULATION	-1.0%~+1.0%	I/P: 230VAC O/P: FULL/ NO LOAD Ta: 25°C	-0.14%~ 0.19%
6	OVER/UNDERSHOOT TEST	<±5 %	I/P: 230VAC O/P: FULL LOAD Ta: 25°C	<5 %
7	RIPPLE & NOISE (Max)	250mVp-p	I/P: 230VAC O/P: FULL LOAD Ta: 25°C	126 mVp-p

high frequency :



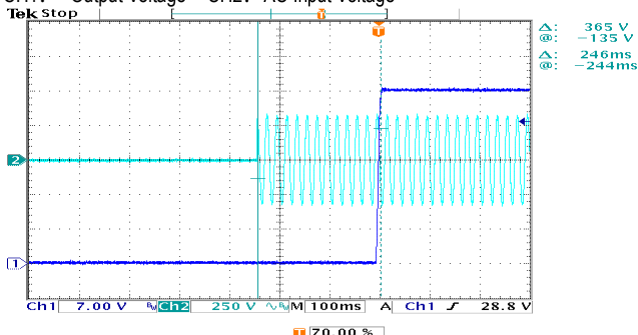
low frequency :



8	SET UP TIME(Max)	230VAC/ 500ms 115VAC/ 2500ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL/80% LOAD Ta: 25°C	230VAC/ 246 ms 115VAC/ 600 ms
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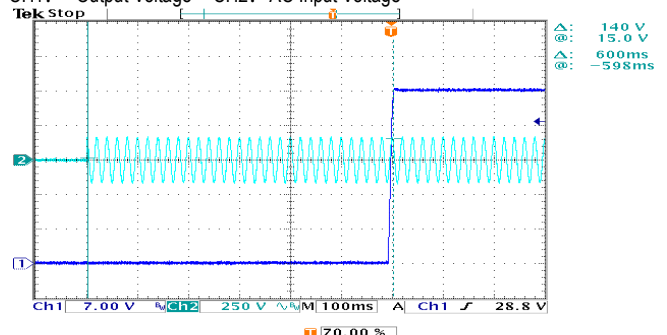
INPUT=230VAC/50HZ @ FULL LOAD

CH1: Output Voltage CH2: AC Input Voltage



INPUT=115VAC/60HZ @ 80% LOAD

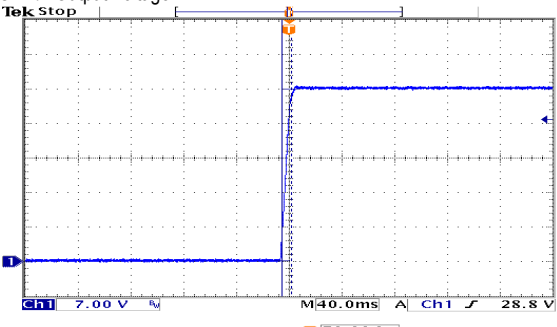
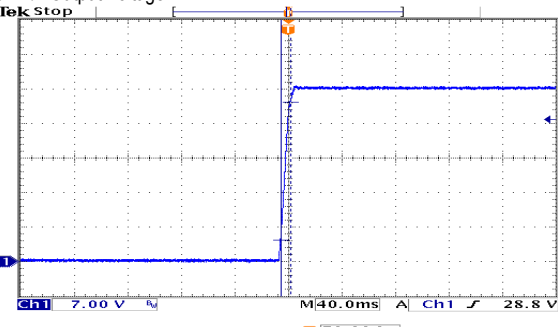
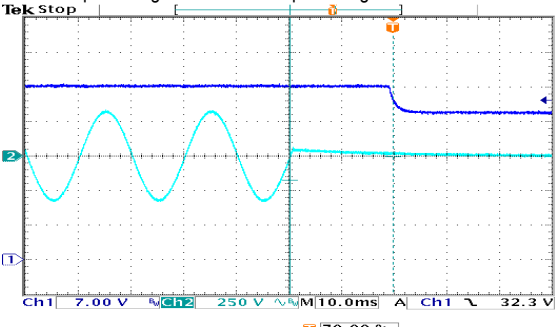
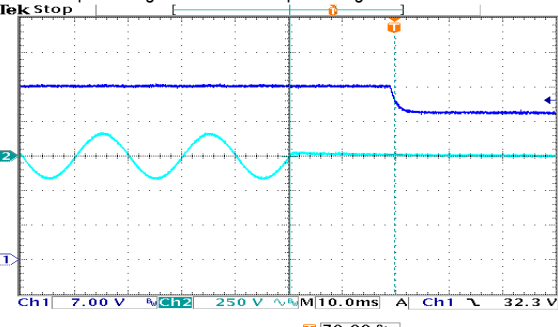
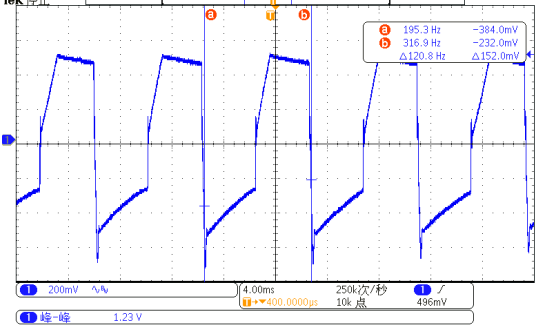
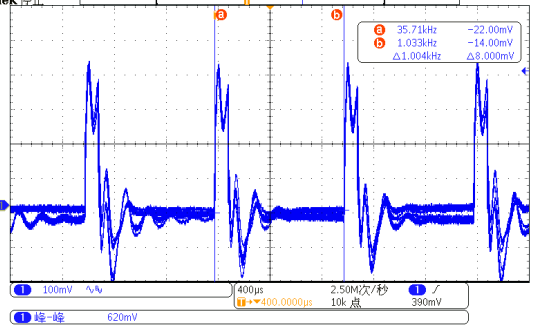
CH1: Output Voltage CH2: AC Input Voltage





200W Constant Voltage + Constant Current LED Driver

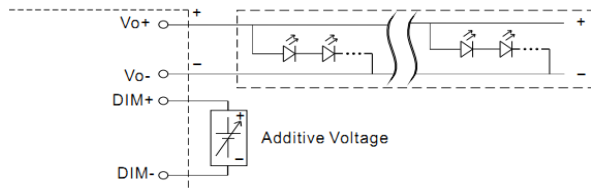
# HBG-200 series

9	RISE TIME (Max)	230VAC/ 100ms 115VAC/ 100ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL/80% LOAD Ta: 25°C	230VAC/ 7.2 ms 115VAC/ 7.2 ms
<p>INPUT=230VAC/50HZ @ FULL LOAD</p> <p>CH1: Output Voltage</p> 		<p>INPUT=115VAC/60HZ @80% LOAD</p> <p>CH1: Output Voltage</p> 		
10	HOLD UP TIME(Typ)	230VAC/ 10ms 115VAC/ 10ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL/80% LOAD Ta: 25°C	230VAC/ 18.0 ms 115VAC/ 22.4 ms
<p>INPUT=230VAC/50HZ @ FULL LOAD</p> <p>CH1: Output Voltage CH2: AC Input Voltage</p> 		<p>INPUT=115VAC/60HZ @ 80% LOAD</p> <p>CH1: Output Voltage CH2: AC Input Voltage</p> 		
11	DYNAMIC LOAD	V1: 3600 mVp-p	I/P: 230VAC O/P: (1) FULL/50% LOAD 50%DUTY / 120HZ (2) FULL /50% LOAD 50%DUTY / 1KHZ Ta: 25°C	(1) 1200mVp-p (2) 620mVp-p
<p>FULL /50% LOAD 50%DUTY / 120HZ</p> 		<p>FULL /50% LOAD 50%DUTY / 1KHZ</p> 		

12 DIMMING OPERATION (for B-Type)

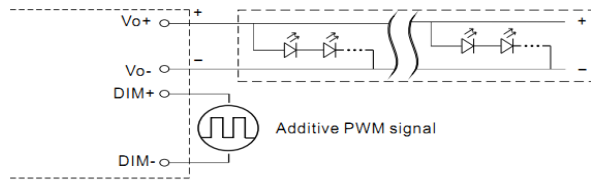
- Output constant current level can be adjusted by applying one of the three methodologies between DIM+ and DIM-: 0 ~ 10Vdc, or 10V PWM signal or resistance.
- Direct connecting to LEDs is suggested. It is not suitable to be used with additional drivers.
- Dimming source current from power supply: 100uA (typ.)

☉ Applying additive 0 ~ 10VDC



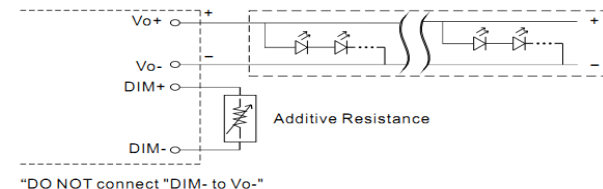
"DO NOT connect "DIM- to Vo-"

☉ Applying additive 10V PWM signal (frequency range 100Hz ~ 3KHz):

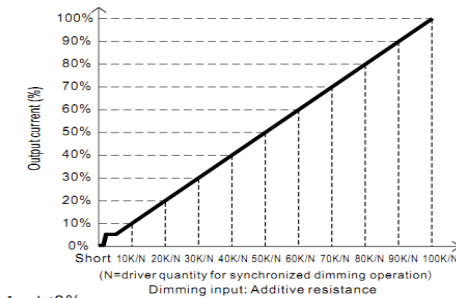
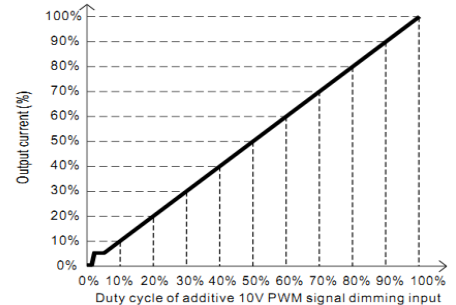
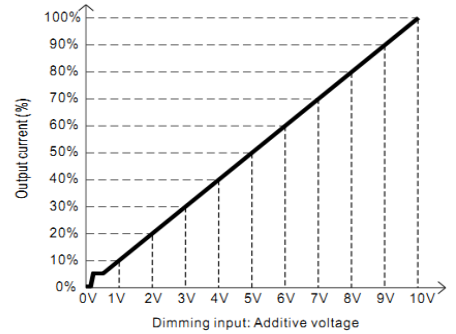


"DO NOT connect "DIM- to Vo-"

☉ Applying additive resistance:



"DO NOT connect "DIM- to Vo-"



Note : 1. Min. dimming level is about 8% and the output current is not defined when 0% < I<sub>out</sub> < 8%.  
 2. The output current could drop down to 0% when dimming input is about 0kΩ or 0Vdc, or 10V PWM signal with 0% duty cycle.

I/P: 230 VAC

O/P: DIMMING TEST

Ta: 25°C

1	DIMMING	Short	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN
	Output Current	0	0.2748A	0.8468A	1.3976A	1.9780A	2.5352A	3.1172A	3.6900A	4.2472A	4.8288A	5.3900A	5.5688A
%	0%	5.00%	15.40%	25.41%	35.96%	46.09%	56.68%	67.09%	77.22%	87.80%	98.00%	101.25%	
2	PWM(100Hz)	0V	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN
	Output Current	0	0.2600A	0.8300A	1.3980A	1.9636A	2.5248A	3.0868A	3.6544A	4.2200A	4.7980A	5.3560A	5.5404A
	%	0%	4.73%	15.09%	25.42%	35.70%	45.91%	56.12%	66.44%	76.73%	87.24%	97.38%	100.73%
3	R	0%	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN
	Output Current	0	0.2688A	0.8404A	1.4204A	2.0080A	2.5908A	3.1836A	3.7808A	4.3880A	5.0068A	5.4900A	5.5484A
	%	0%	4.89%	15.28%	25.83%	36.51%	47.11%	57.88%	68.74%	79.78%	91.03%	99.82%	100.88%

TEST RESULT: OK

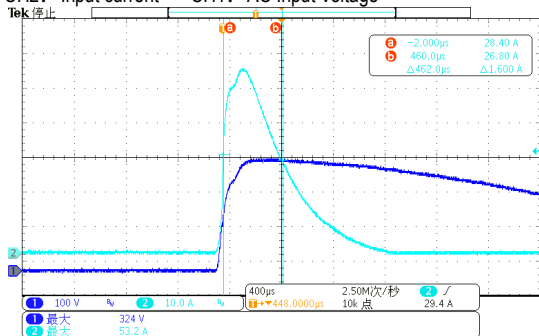
13	DALI DIMMING OPERATION (primary side : for DA-Type)	<p>※DALI Interface          ·Apply DALI signal between DA+ and DA-.          ·DALI protocol comprises 16 groups and 64 addresses.          ·First step is fixed at 8% of output.</p> <p>I/P: 230 VAC          O/P: DIMMING TEST          Ta: 25°C          TEST RESULT: OK</p>
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## INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~305VAC	I/P: TESTING O/P: 60% ~FULL LOAD Ta: 25°C	87 V~ 305 V
			(1)I/P: LOW-LINE-3V=87 V HIGH-LINE+10V=315 V O/P: 60% ~FULL LOAD ON: 30 Sec OFF: 30 Sec 10MIN (2)230VAC ON: 0.5 Sec OFF: 0.5 Sec 20MIN ( 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 ~NO LOAD Ta: 25°C	TEST: OK
3	AC CURRENT	1.9A/115VAC 1.0A/230VAC 0.9A/277VAC	I/P: 115 VAC I/P: 230 VAC I/P: 277 VAC O/P: FULL /80% LOAD Ta: 25°C	I = 1.51 A/ 115VAC I = 0.89 A/ 230VAC I = 0.76 A/ 277VAC
4	LEAKAGE CURRENT	< 0.75mA / 277VAC	I/P: 277 VAC O/P: NO LOAD Ta: 25°C	L-FG: 0.353 mA N-FG: 0.347 mA
6	INRUSH CURRENT(Typ)	230V/ 85A Twidth =600us measured at 50% Ipeak COLD START	I/P: 230 VAC O/P: FULL LOAD Ta: 25°C	I = 53.2 A/ 230VAC Twidth =462 us

INPUT=230VAC/50HZ @ FULL LOAD

CH2: Input current CH1: AC Input Voltage



7	EFFICIENCY(Typ)	92%	I/P: 230VAC O/P: FULL LOAD Ta: 25°C	93.42%																																												
<p><b>EFFICIENCY vs LOAD</b></p> <table border="1"> <caption>Efficiency vs Load Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>277V (%)</th> <th>230V (%)</th> <th>115V (%)</th> </tr> </thead> <tbody> <tr><td>10%</td><td>65</td><td>65</td><td>65</td></tr> <tr><td>20%</td><td>78</td><td>78</td><td>78</td></tr> <tr><td>30%</td><td>84</td><td>84</td><td>84</td></tr> <tr><td>40%</td><td>87</td><td>87</td><td>87</td></tr> <tr><td>50%</td><td>89</td><td>89</td><td>89</td></tr> <tr><td>60%</td><td>90</td><td>90</td><td>90</td></tr> <tr><td>70%</td><td>91</td><td>91</td><td>91</td></tr> <tr><td>80%</td><td>92</td><td>92</td><td>92</td></tr> <tr><td>90%</td><td>93</td><td>93</td><td>93</td></tr> <tr><td>100%</td><td>93.42</td><td>93.42</td><td>93.42</td></tr> </tbody> </table>					LOAD (%)	277V (%)	230V (%)	115V (%)	10%	65	65	65	20%	78	78	78	30%	84	84	84	40%	87	87	87	50%	89	89	89	60%	90	90	90	70%	91	91	91	80%	92	92	92	90%	93	93	93	100%	93.42	93.42	93.42
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8	POWER FACTOR	0.98/ 115VAC 0.95/ 230VAC 0.92/ 277VAC	I/P: 115 VAC I/P: 230 VAC I/P: 277 VAC O/P: FULL LOAD/80% LOAD Ta: 25°C	PF= 0.996 / 115VAC PF= 0.981 / 230VAC PF= 0.961 / 277VAC																																												
<p><b>P.F vs LOAD</b></p> <table border="1"> <caption>P.F vs Load Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>277V</th> <th>230V</th> <th>115V</th> </tr> </thead> <tbody> <tr><td>50%</td><td>0.91</td><td>0.95</td><td>0.98</td></tr> <tr><td>60%</td><td>0.92</td><td>0.96</td><td>0.98</td></tr> <tr><td>70%</td><td>0.93</td><td>0.97</td><td>0.98</td></tr> <tr><td>80%</td><td>0.94</td><td>0.975</td><td>0.98</td></tr> <tr><td>90%</td><td>0.95</td><td>0.98</td><td>0.98</td></tr> <tr><td>100%</td><td>0.96</td><td>0.985</td><td>0.98</td></tr> </tbody> </table>					LOAD (%)	277V	230V	115V	50%	0.91	0.95	0.98	60%	0.92	0.96	0.98	70%	0.93	0.97	0.98	80%	0.94	0.975	0.98	90%	0.95	0.98	0.98	100%	0.96	0.985	0.98																
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9	TOTAL HARMONIC DISTORTION	THD < 20% ( @load ≥ 60% / 115VAC, 230VAC; @load ≥ 75% / 277VAC )	I/P: 115 VAC / 60% LOAD I/P: 230 VAC / 60% LOAD I/P: 277 VAC / 75% LOAD Ta: 25°C	THD=9.12% @60% load / 115VAC THD=12.75% @60% load / 230VAC THD=12.74% @75% load / 277VAC																																												
<p><b>THD vs LOAD</b></p> <table border="1"> <caption>THD vs Load Data</caption> <thead> <tr> <th>LOAD (%)</th> <th>277V (%)</th> <th>230V (%)</th> </tr> </thead> <tbody> <tr><td>50%</td><td>17</td><td>14</td></tr> <tr><td>60%</td><td>15</td><td>13</td></tr> <tr><td>70%</td><td>13</td><td>12</td></tr> <tr><td>80%</td><td>12</td><td>11</td></tr> <tr><td>90%</td><td>11</td><td>10</td></tr> <tr><td>100%</td><td>10</td><td>9</td></tr> </tbody> </table>					LOAD (%)	277V (%)	230V (%)	50%	17	14	60%	15	13	70%	13	12	80%	12	11	90%	11	10	100%	10	9																							
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## PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER CURRENT PROTECTION	95%~108%	I/P: 90VAC I/P: 230VAC I/P: 305VAC O/P: TESTING Ta: 25°C	100.62 %/ 90VAC 100.65 %/ 230VAC 100.11 %/ 305VAC Constant Current Limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	41V~47V	I/P: 90VAC I/P: 230VAC I/P: 305VAC O/P: NO LOAD Ta: 25°C	43.77 V/ 90VAC 43.83 V/ 230VAC 43.85 V/ 305VAC Shut down o/p voltage with auto-recovery or re-power on to recovery
3	OVER TEMPERATURE PROTECTION	NO DAMAGE	I/P: 230VAC O/P: FULL LOAD	Shut down o/p voltage, recovers automatically after temperature goes down
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 305VAC O/P: FULL LOAD Ta: 25°C	NO DAMAGE Hiccup mode or constant current limiting, recovers automatically after fault condition is removed

## COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Power Transistor	Q5 Rated 13.8A/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) 504 V (2) 444 V (3) 502 V
2	O/P Diode (MOSFET)	D100 Rated 30A/100V	I/P: High-Line +3V =308V O/P: (1) FULL LOAD Turn on (2) Output Short (3) FULL LOAD continue Ta: 25°C	(1)88.8 V (2) 25.6 V (3)87.5 V
3	Input Capacitor	C5 Rated 100u/ 450V	I/P: High-Line +3V =308 V O/P: (1) FULL LOAD input on/off (2) NO LOAD input on /Off (3) FULL LOAD /NO LOAD Change Ta: 25°C	(1) 449 V (2) 447 V (3) 448 V
4	Control IC	U2 Rated 16V (MAX.)	I/P: High-Line +3V =308 V O/P: ((1) FULL LOAD (2) Output Short (3) O.L.P (4) O.V.P (5) Low Line No Load Vo(min) Ta: 25°C	(1) 15.1 V (2) 13.8 V (3) 14.4 V (4) 14.2 V (5) 13.4 V
5	PFC Power Transistor	Q 1 Rated 16.8A/650V	I/P: High-Line +3V =308V O/P: (1) FULL LOAD Turn on (2) Output Short (3) FULL LOAD continue Ta: 25°C	(1) 574 V (2) 540 V (3) 572 V

## SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3.75KVAC/min I/P-FG: 2.0KVAC/min O/P-FG: 0.5KVAC/min	I/P-O/P: 4.2KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG: 0.6 KVAC/min Ta: 25°C	I/P-O/P: 2.454 mA I/P-FG: 2.103 mA O/P-FG: 3.899 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	I/P-O/P: >9999 MΩ I/P-FG: >9999 MΩ O/P-FG: >9999 MΩ
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 50 mΩ EN 60950-1	40 A / 2 min Ta:25°C / 70%RH	17mΩ

## E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 Class C	I/P: 230VAC/50HZ O/P: FULL/60% LOAD Ta: 25°C	PASS
2	CONDUCTION	EN55015	I/P: 230 VAC (50HZ) O/P: FULL LOAD Ta: 25°C	PASS Test by certified Lab
3	RADIATION	EN55015	I/P: 230 VAC (50HZ) O/P: FULL LOAD Ta: 25°C	PASS Test by certified Lab
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	PASS
5	E.F.T	EN61000-4-4 LIGHT INDUSTRY INPUT: 1KV	I/P: 230VAC/50HZ O/P: FULL LOAD Ta: 25°C	PASS
6	SURGE	EN61000-4-5 INDUSTRY L-N: 2KV L,N-PE: 4KV	I/P: 230VAC/50HZ O/P: FULL LOAD Ta: 25°C	PASS
7	Test by certified Lab & Test Report Prepare			



## RELIABILITY TEST

### ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT																																																																																				
1	TEMPERATURE RISE TEST	MODEL: HBG-200-36 1. ROOM AMBIENT BURN-IN: 2 HRS I/P: 230VAC O/P: 95% LOAD Ta=26.3 °C 2. HIGH AMBIENT BURN-IN: 2 HRS I/P: 230VAC O/P: 95% LOAD Ta=60.4 °C																																																																																						
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P: 305VAC/90VAC O/P: FULL/60% LOAD Ta= -45°C /-35°C	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: 305VAC O/P: FULL LOAD Ta=50°C HUMIDITY= 95 %R.H	TEST: OK																																																																																				
4	TEMPERATURE COEFFICIENT	±0.03 %/°C (0~50°C)	I/P: 230 VAC O/P: FULL LOAD	±0.004 %/°C (0~50°C)																																																																																				
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		TEST: OK																																																																																				



200W Constant Voltage + Constant Current LED Driver

# HBG-200 series

6	THERMAL SHOCK TEST	1. Thermal shock Temperature: $-45^{\circ}\text{C} \sim +55^{\circ}\text{C}$ 2. Temperature change rate : $25^{\circ}\text{C} / \text{MIN}$ 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle: 10 CYCLE 5. Input/Output condition: 230VAC/95% LOAD AC ON/OFF TEST AC on 3 sec/AC off 1 sec TEST	TEST: 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: $25^{\circ}\text{C}$	TEST: OK																		
8	CAPACITOR LIFE CYCLE	HBG-200-36: SUPPOSE C102 IS THE MOST CRITICAL COMPONENT (1) I/P: 230VAC O/P: FULL LOAD Ta= $25^{\circ}\text{C}$ LIFE TIME (2) I/P: 230VAC O/P: FULL LOAD Ta= $60^{\circ}\text{C}$ LIFE TIME (3) I/P: 230VAC O/P: 75% LOAD Ta= $60^{\circ}\text{C}$ LIFE TIME (4) I/P: 230VAC O/P: 50% LOAD Ta= $60^{\circ}\text{C}$ LIFE TIME	(1) 500459 HRS (2) 48713 HRS (3) 63525 HRS (4) 104544 HRS																		
9	MTBF	Conducted by Parts Stress Analysis Prediction 2042.7K hrs min. Telcordia SR-332 (Bellcore); 207.4K hrs min. MIL-HDBK-217F ( $25^{\circ}\text{C}$ )																			
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : Above 50000 hours @ Tc $70^{\circ}\text{C}$ <table border="1"> <caption>Graph Data: Lifetime vs Tcase</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>50</td></tr> <tr><td>80</td><td>20</td></tr> <tr><td>90</td><td>15</td></tr> </tbody> </table>		Tcase (°C)	LIFETIME(kh)	20	100	30	100	40	100	50	100	60	100	70	50	80	20	90	15
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TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	SHENJW/ZHUOKB	SKY	LIUWY