



Test Report: HBG-200-48

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

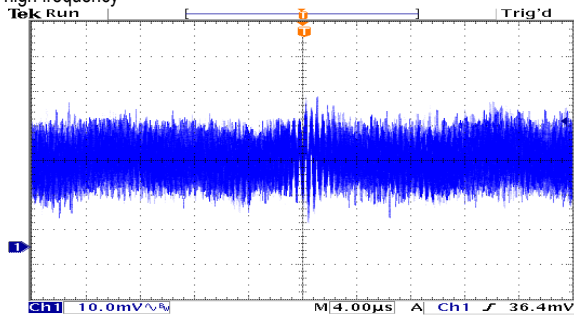
Environment Test

DESIGN VERIFY TEST

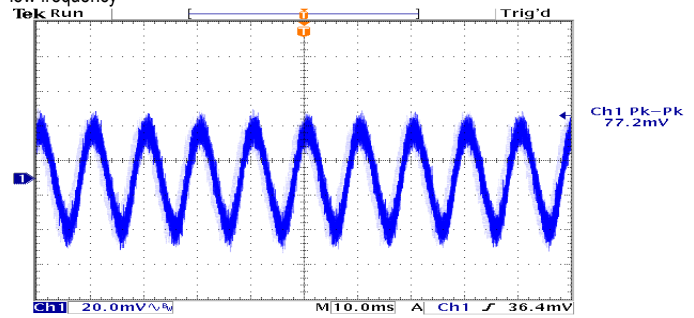
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONSTANT CURRENT REGION	28.8 V~ 48 V	I/P: 230VAC O/P: LED MODE Ta: 25°C	8V~ 48 V
2	OUTPUT CURRENT ADJUST RANGE (For A-Type And AB-Type)	2.46A~4.1A	I/P: 230VAC O/P: SETING Ta: 25°C	1.164A~4.782A
3	OUTPUT VOLTAGE TOLERANCE	-2%~+2%	I/P: 90VAC / 305VAC O/P: FULL/60%/ NO LOAD Ta: 25°C	-0.058%~ +0.058%
4	LINE REGULATION	-0.5%~+0.5%	I/P: 90VAC ~ 305VAC O/P: 60% ~ FULL LOAD Ta: 25°C	-0.00%~ 0.04%
5	LOAD REGULATION	-1.0%~+1.0%	I/P: 230VAC O/P: FULL/ NO LOAD Ta: 25°C	-0.08%~ 0.1%
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	77.2 mVp-p

high frequency :



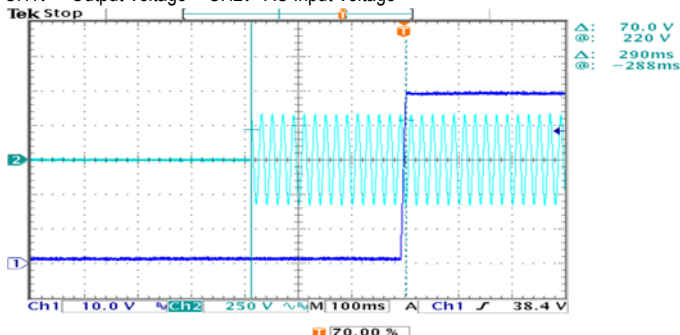
low frequency :



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/ 290 ms 115VAC/394 ms
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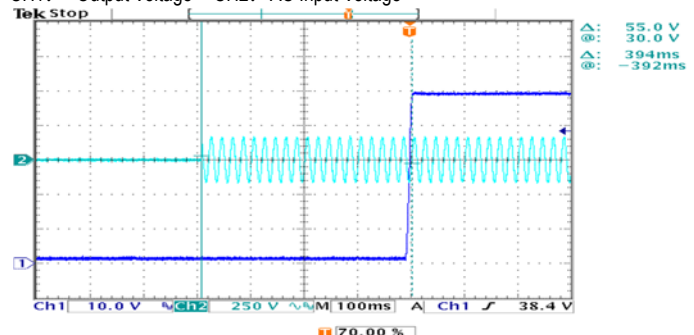
INPUT=230VAC/50HZ @ FULL LOAD

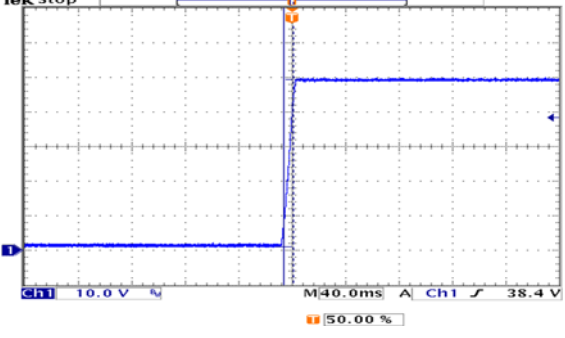
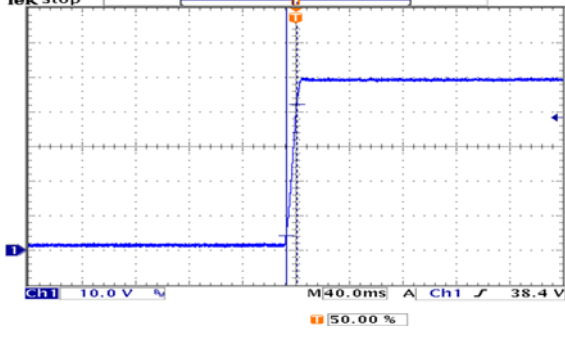
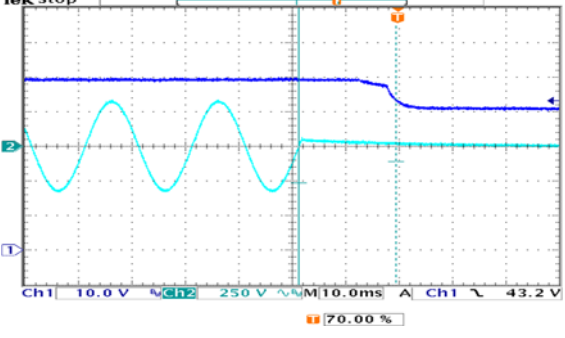
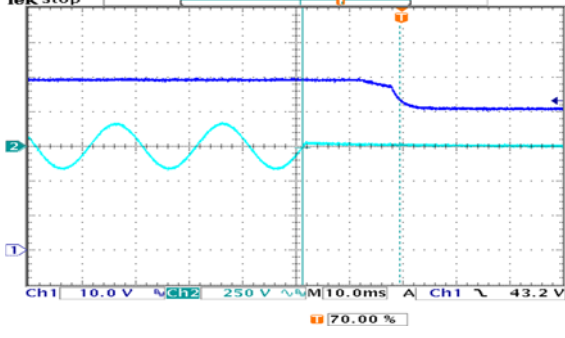
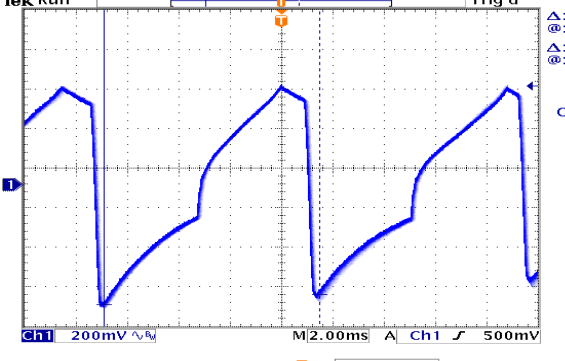
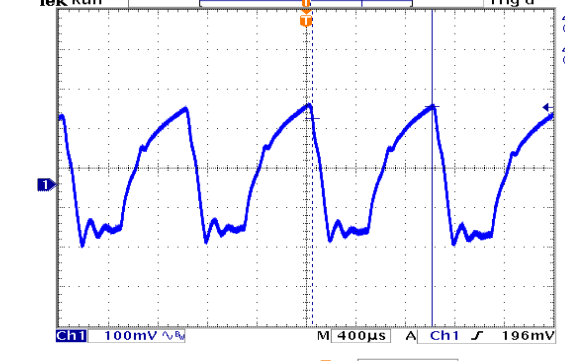
CH1: Output Voltage CH2: AC Input Voltage



INPUT=115VAC/60HZ @ 80% LOAD

CH1: Output Voltage CH2: AC Input Voltage

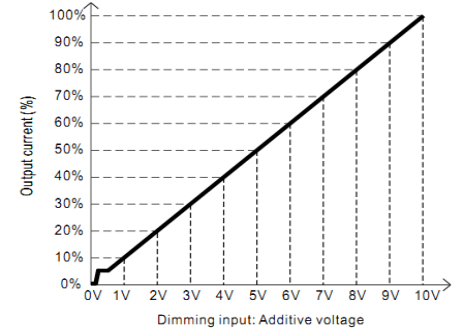
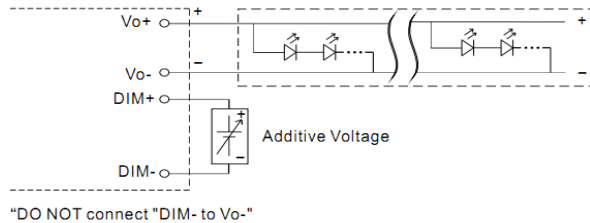


9	RISE TIME (Max)	230VAC/ 100ms 115VAC/ 100ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL/80% LOAD Ta: 25°C	230VAC/ 7.2 ms 115VAC/8.0 ms
INPUT=230VAC/50HZ @ FULL LOAD CH1: Output Voltage  INPUT=115VAC/60HZ @ 80% LOAD CH1: Output Voltage 				
10	HOLD UP TIME(Typ)	230VAC/ 10ms 115VAC/ 10ms	I/P: 230 VAC I/P: 115 VAC O/P: FULL/80% LOAD Ta: 25°C	230VAC/18.2 ms 115VAC/18.2 ms
INPUT=230VAC/50HZ @ FULL LOAD CH1: Output Voltage CH2: AC Input Voltage  INPUT=115VAC/60HZ @ 80% LOAD CH1: Output Voltage CH2: AC Input Voltage 				
11	DYNAMIC LOAD	V1: 4800 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) 1120mVp-p (2) 364mVp-p
FULL /50% LOAD 50%DUTY / 120HZ  FULL /50% LOAD 50%DUTY / 1KHZ 				

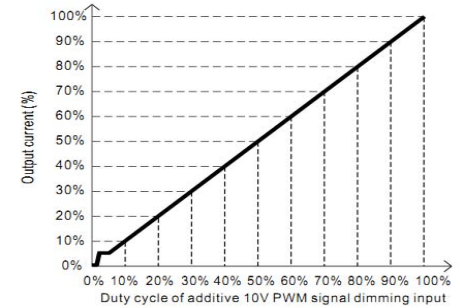
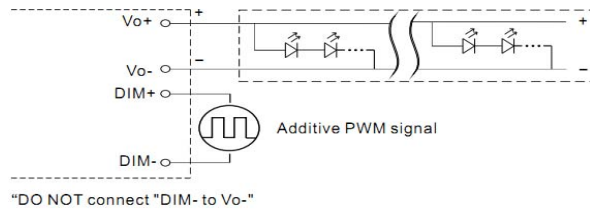
12 DIMMING OPERATION (for B-Type)

- 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.)

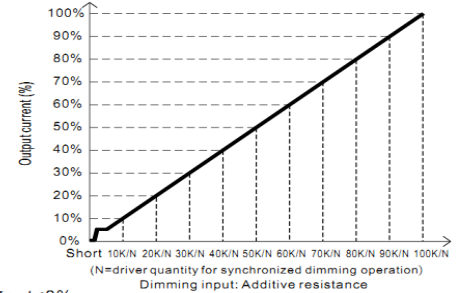
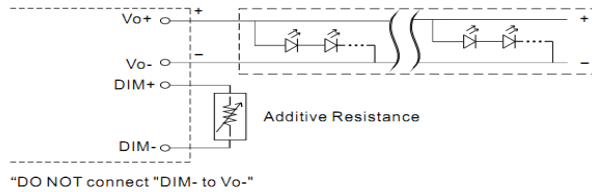
◎ Applying additive 0 ~ 10VDC



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



◎ Applying additive resistance:



Note : 1. Min. dimming level is about 8% and the output current is not defined when 0% < Iout < 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

	DIMMING	Short	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	OPEN
1	Output Current	0	0.3420A	0.7616A	1.1626A	1.5792A	1.9904A	2.4156A	2.8388A	3.2496A	3.6716A	4.0756A	4.1900A
	%	0%	8.34%	18.58%	28.36%	38.52%	48.55%	58.92%	69.24%	79.26%	89.55%	99.40%	102.20%
2	PWM(100Hz)	0V	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	OPEN
	Output Current	0	0.3444A	0.7596A	1.1740A	1.5840A	1.9968A	2.4128A	2.8312A	3.2504A	3.6652A	4.0700A	4.2176A
	%	0%	8.40%	18.53%	28.63%	38.63%	48.70%	58.85%	69.05%	79.28%	89.40%	99.27%	102.87%
3	R	0%	10K	20K	30K	40K	50K	60K	70K	80K	90K	100K	OPEN
	Output Current	0	0.3428A	0.7648A	1.1876A	1.6060A	2.0272A	2.4504A	2.8816A	3.3120A	3.7412A	4.1308A	4.2012A
	%	0%	8.36%	18.65%	28.97%	39.17%	49.44%	59.77%	70.28%	80.78%	91.25%	100.70%	102.47%

TEST RESULT: OK

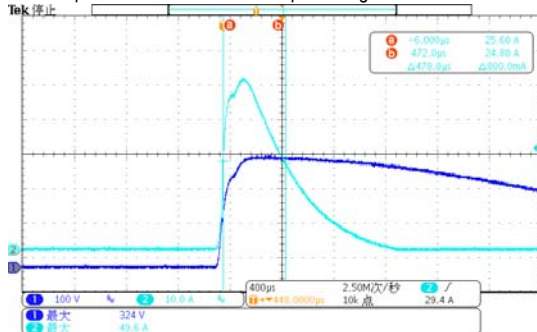
13	DALI DIMMING OPERATION (primary side; for DA-Type)	※DALI Interface ·Apply DALI signal between DA+ and DA-. ·DALI protocol comprises 16 groups and 64 addresses. ·First step is fixed at 8% of output. I/P: 230 VAC O/P: DIMMING TEST Ta: 25°C TEST RESULT: OK
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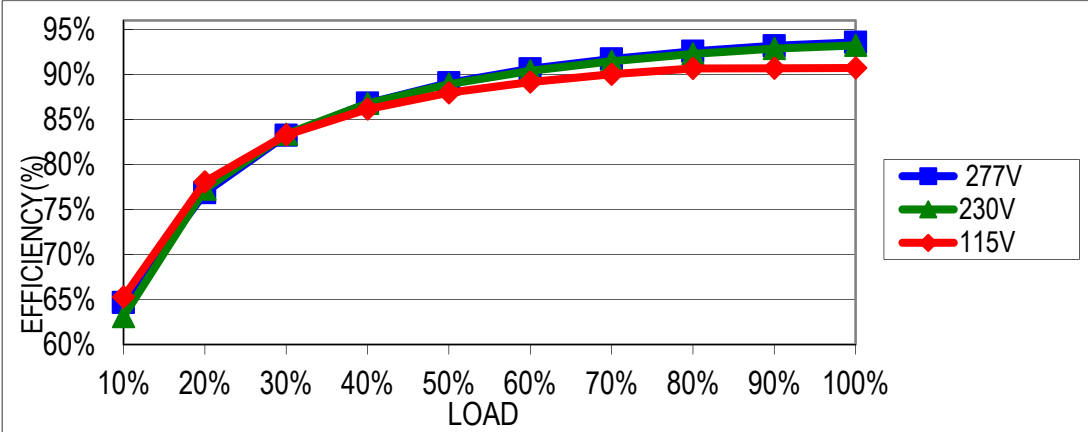
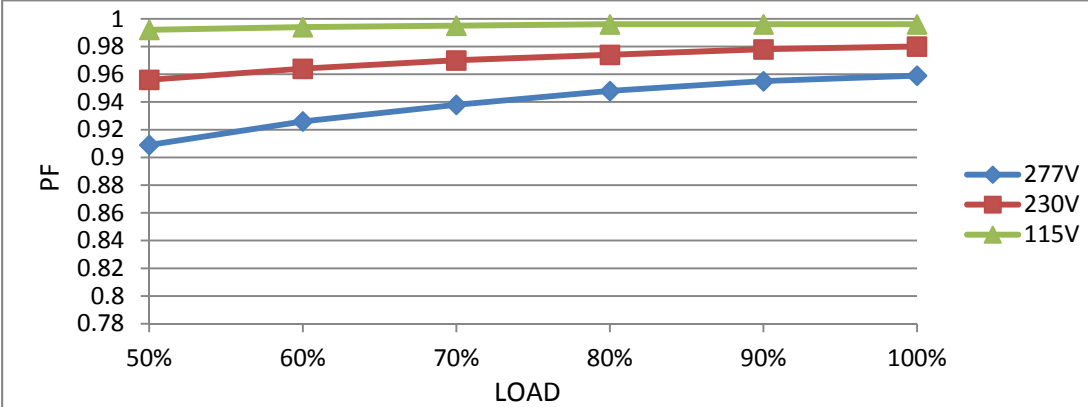
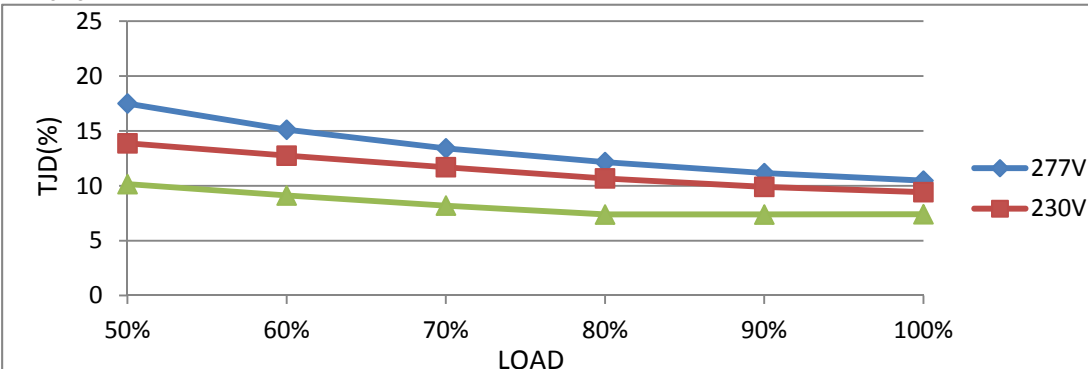
INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	90VAC~305VAC	I/P: TESTING O/P: 60% ~FULL LOAD Ta: 25°C (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)	87 V~ 305 V 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 = 1.00 A/ 115VAC I = 0.98 A/ 230VAC I = 0.96A/ 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: 0.338 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 = 49.6 A/ 230VAC Twidth =478us

INPUT=230VAC/50HZ @ FULL LOAD

CH2: Input current CH1: AC Input Voltage



7	EFFICIENCY(Typ)	93%	I/P: 230VAC O/P: FULL LOAD Ta: 25°C	93.24%																																												
EFFICIENCY vs LOAD <table border="1"><caption>Efficiency vs Load Data (Approximate)</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>63</td><td>65</td></tr><tr><td>20</td><td>78</td><td>76</td><td>78</td></tr><tr><td>30</td><td>84</td><td>83</td><td>84</td></tr><tr><td>40</td><td>87</td><td>86</td><td>87</td></tr><tr><td>50</td><td>89</td><td>88</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</td><td>93</td><td>93</td></tr></tbody></table>					Load (%)	277V (%)	230V (%)	115V (%)	10	65	63	65	20	78	76	78	30	84	83	84	40	87	86	87	50	89	88	89	60	90	90	90	70	91	91	91	80	92	92	92	90	93	93	93	100	93	93	93
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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= 0.980 / 230VAC PF= 0.959 / 277VAC																																												
P.F vs LOAD <table border="1"><caption>P.F vs Load Data (Approximate)</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>0.96</td><td>0.99</td></tr><tr><td>60</td><td>0.93</td><td>0.97</td><td>0.99</td></tr><tr><td>70</td><td>0.94</td><td>0.97</td><td>0.99</td></tr><tr><td>80</td><td>0.95</td><td>0.98</td><td>0.99</td></tr><tr><td>90</td><td>0.96</td><td>0.98</td><td>0.99</td></tr><tr><td>100</td><td>0.96</td><td>0.98</td><td>0.99</td></tr></tbody></table>					Load (%)	277V	230V	115V	50	0.91	0.96	0.99	60	0.93	0.97	0.99	70	0.94	0.97	0.99	80	0.95	0.98	0.99	90	0.96	0.98	0.99	100	0.96	0.98	0.99																
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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=8.90% @60% load /115VAC THD=12.60% @60% load /230VAC THD=12.88% @75% load /277VAC																																												
THD vs LOAD <table border="1"><caption>THD vs Load Data (Approximate)</caption><thead><tr><th>Load (%)</th><th>277V (%)</th><th>230V (%)</th><th>115V (%)</th></tr></thead><tbody><tr><td>50</td><td>18</td><td>14</td><td>10</td></tr><tr><td>60</td><td>15</td><td>13</td><td>9</td></tr><tr><td>70</td><td>14</td><td>12</td><td>8</td></tr><tr><td>80</td><td>12</td><td>11</td><td>7</td></tr><tr><td>90</td><td>11</td><td>10</td><td>7</td></tr><tr><td>100</td><td>10</td><td>9</td><td>7</td></tr></tbody></table>					Load (%)	277V (%)	230V (%)	115V (%)	50	18	14	10	60	15	13	9	70	14	12	8	80	12	11	7	90	11	10	7	100	10	9	7																
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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	99.75 %/ 90VAC 99.75 %/ 230VAC 99.75 %/ 305VAC Constant Current Limiting, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	54V~62V	I/P: 90VAC I/P: 230VAC I/P: 305VAC O/P: NO LOAD Ta: 25°C	57.96 V/ 90VAC 58.06 V/ 230VAC 58.11 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	NO DAMAGE 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) 456 V (2) 450 V (3) 454 V
2	O/P Diode (MOSFET)	D100 Rated 30A/150V	I/P: High-Line +3V =308V O/P: (1) FULL LOAD Turn on (2) Output Short (3) FULL LOAD continue Ta: 25°C	(1)113 V (2) 12.8 V (3)111 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) 449 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) 14.0 V (2) 15.1 V (3) 14.6 V (4) 13.6 V (5) 13.5 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) 484 V (2) 454 V (3) 482 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: 2.405 mA I/P-FG: 2.070 mA O/P-FG: 3.754 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

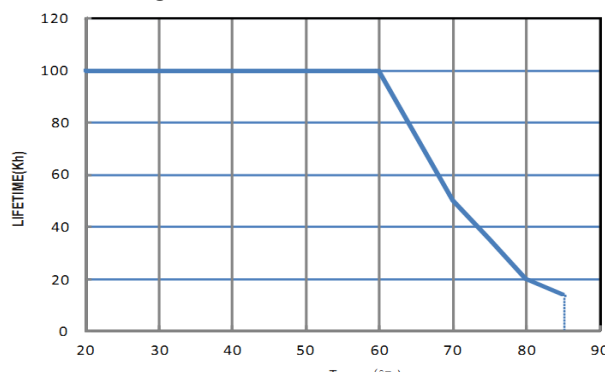
E.M.C TEST

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-200-48 1. ROOM AMBIENT BURN-IN: 2 HRS I/P: 230VAC O/P: 95% LOAD Ta=26.3 ℃ 2. HIGH AMBIENT BURN-IN: 2 HRS I/P: 230VAC O/P: 95% LOAD Ta=60.4 ℃ <table><thead><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=26.3 ℃</th><th>HIGH AMBIENT Ta=60.4 ℃</th></tr></thead><tbody><tr><td>1</td><td>C2</td><td>49.9℃</td><td>82.3℃</td></tr><tr><td>2</td><td>BD1</td><td>56.1℃</td><td>88.2℃</td></tr><tr><td>3</td><td>RTH1</td><td>63.8℃</td><td>89.8℃</td></tr><tr><td>4</td><td>Q1</td><td>54.2℃</td><td>87.3℃</td></tr><tr><td>5</td><td>D5</td><td>55.5℃</td><td>88.9℃</td></tr><tr><td>6</td><td>C5</td><td>53.8℃</td><td>86.2℃</td></tr><tr><td>7</td><td>Q5</td><td>56.8℃</td><td>91.0℃</td></tr><tr><td>8</td><td>Q6</td><td>56.7℃</td><td>91.0℃</td></tr><tr><td>9</td><td>C13</td><td>55.0℃</td><td>88.3℃</td></tr><tr><td>10</td><td>C61</td><td>53.3℃</td><td>87.0℃</td></tr><tr><td>11</td><td>U1</td><td>50.8℃</td><td>83.6℃</td></tr><tr><td>12</td><td>U2</td><td>50.4℃</td><td>83.5℃</td></tr><tr><td>13</td><td>T1</td><td>63.1℃</td><td>96.1℃</td></tr><tr><td>14</td><td>D100</td><td>64.2℃</td><td>97.1℃</td></tr><tr><td>15</td><td>D101</td><td>63.0℃</td><td>95.8℃</td></tr><tr><td>16</td><td>C102</td><td>54.9℃</td><td>87.2℃</td></tr><tr><td>17</td><td>C103</td><td>57.7℃</td><td>89.8℃</td></tr><tr><td>18</td><td>C205</td><td>54.5℃</td><td>86.8℃</td></tr><tr><td>19</td><td>RTH2</td><td>49.8℃</td><td>82.1℃</td></tr><tr><td>20</td><td>TC</td><td>45.3℃</td><td>77.0℃</td></tr></tbody></table>			NO	Position	ROOM AMBIENT Ta=26.3 ℃	HIGH AMBIENT Ta=60.4 ℃	1	C2	49.9℃	82.3℃	2	BD1	56.1℃	88.2℃	3	RTH1	63.8℃	89.8℃	4	Q1	54.2℃	87.3℃	5	D5	55.5℃	88.9℃	6	C5	53.8℃	86.2℃	7	Q5	56.8℃	91.0℃	8	Q6	56.7℃	91.0℃	9	C13	55.0℃	88.3℃	10	C61	53.3℃	87.0℃	11	U1	50.8℃	83.6℃	12	U2	50.4℃	83.5℃	13	T1	63.1℃	96.1℃	14	D100	64.2℃	97.1℃	15	D101	63.0℃	95.8℃	16	C102	54.9℃	87.2℃	17	C103	57.7℃	89.8℃	18	C205	54.5℃	86.8℃	19	RTH2	49.8℃	82.1℃	20	TC	45.3℃	77.0℃
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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℃/-35℃	TEST: OK																																																																																				
3	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50℃ NO DAMAGE	I/P: 305VAC O/P: FULL LOAD Ta=50℃ HUMIDITY= 95 %R.H	TEST: OK																																																																																				
4	TEMPERATURE COEFFICIENT	±0.03 %/℃ (0~50℃)	I/P: 230 VAC O/P: FULL LOAD	±0.0041 %/℃ (0~50℃)																																																																																				
5	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature: -45℃ ~ +85℃ 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		TEST: OK																																																																																				

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/ FULL 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°C	TEST: OK
8	CAPACITOR LIFE CYCLE	HBG-200-48: 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= 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) 476362 HRS (2) 47690 HRS (3) 60023 HRS (4) 96993 HRS
9	MTBF	Conducted by Parts Stress Analysis Prediction 252.3K hrs min MIL-HDBK-217F (25°C)	
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : Above 50000 hours @ Tc 70°C 	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	SHENJW/ZHUOKB	SKY	LIUWY