



# Test Report: HBG-240-48

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240W Single Output Switching Power Supply

## ■ 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 : 250 mVp-p (Max)	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	V1 : 40 mVp-p (Max)	P
2	CONSTANT CURRENT REGION	CH1: 28.8 V ~ 48 V	I/P : 230VAC O/P : CV MODE Ta : 25°C	O/P= 28.8V : 5.072 A O/P= 48 V : 5.046 A	P
3	CURRENT ADJUST RANGE	CH1: 3.0A ~ 5.0 A	I/P : 230VAC I/P : 115VAC O/P : CV MODE Ta : 25°C	2.164 A ~ 5.258 A /230VAC 2.166 A ~ 5.261 A /115VAC	P
4	OUTPUT VOLTAGE TOLERANCE	V1 : 1%~ -1% (Max)	I/P : 100 VAC / 305 VAC O/P : FULL/ MIN LOAD Ta : 25°C	V1 : 0.573 %~ -0.064 %	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 %~ 0 %	P
6	LOAD REGULATION	V1 : 0.5%~ -0.5% (Max)	I/P : 230 VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.052 %~ -0.064 %	P
7	SET UP TIME	230VAC : 2500 ms (Max) 115VAC : 2500 ms(Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 1538 ms 115VAC/ 1688 ms	P
8	RISE TIME	230VAC : 120 ms (Max) 115VAC : 120 ms (Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 47.49 ms 115VAC/ 46.04 ms	P
9	HOLD UP TIME	230VAC : 15 ms (TYP) 115VAC : 15 ms (TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 26.88 ms 115VAC/ 26.50 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 : 4800 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) 366 mVp-p (2) 3600 mVp-p	P

12	DIMMER TEST	SPEC:										
		*Output constant current level can be adjusted through output cable by 1 ~ 10Vdc, PWM signal or resistor between ADJ1(+) and ADJ2(-).										
		*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	0.434A	0.929A	1.418A	1.891A	2.381A	2.872A	3.370A	3.868A	4.364A	4.862A	
	%	8.68%	18.58%	28.36%	37.82%	47.62%	57.44%	67.40%	77.36%	87.28%	97.24%	
2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	
	Output current	0.453A	0.974A	1.495A	1.979A	2.492A	3.018A	3.543A	4.070A	4.600A	5.077A	
	%	9.06%	19.48%	29.90%	39.58%	49.84%	60.36%	70.86%	81.40%	92.00%	101.5%	
3	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
	Output current	0.493A	1.001A	1.506A	1.990A	2.501A	3.012A	3.526A	4.046A	4.560A	5.024A	
	%	9.86%	20.02%	30.12%	39.80%	50.02%	60.24%	70.52%	80.92%	91.20%	100.5%	

P

**INPUT FUNCTION TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	100VAC~305 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C  I/P : LOW-LINE-3V=97 V HIGH-LINE=305 V O/P : FULL/MIN LOAD ON : 30 Sec . OFF : 30 Sec 10MIN ( AC POWER ON/OFF NO DAMAGE )	87 V~305V  TEST : OK	P
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P : 100 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) 0.93 / 277 VAC(TYP)	I/P : 230 VAC I/P : 115 VAC I/P : 277 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.968 / 100% PF= 0.997 / 100% PF= 0.938 / 100%	P
4	EFFICIENCY	93% (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	93.41 %	P
5	INPUT CURRENT	230V/ 1.3 A (TYP) 115V/ 2.5 A (TYP) 277V/ 1.2 A (TYP)	I/P : 230 VAC I/P : 115 VAC I/P : 277 VAC O/P : FULL LOAD Ta : 25°C	I= 1.142 A/ 230 VAC I= 2.304 A/ 115 VAC I= 0.969 A/ 277 VAC	P
6	INRUSH CURRENT	230V/ 75 A (TYP) COLD START	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	I= 67.95 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 : 0.3824 mA N-CASE : 0.3722 mA	P

**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	100.92 %/ 230 VAC 100.84 %/ 115 VAC Constant current limiting ,recovers automatically after fault condition is removed	P
2	OVER VOLTAGE PROTECTION	CH1 : 52 V ~ 63 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	55.4 V/ 230 VAC 55.4 V/ 115 VAC Shut down o/p voltage, re-power on to recover	P
3	OVER TEMPERATURE PROTECTION	SPEC : TSW1 : 95± 5°C O.T.P. 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 : STF26NM60N: 600V/20A	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) 468 V (2) 460 V (3) 452 V	P
2	Diode Peak Voltage	Q101 Rated : V30150C: 150 V/ 30 A	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) 111 V (2) 16.7 V (3) 105 V	P
3	Input Capacitor Voltage	C5 Rated : 150u/450V 105°C 18*45 CST	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) 446 V (2) 442 V (3) 444 V	P
4	Control IC Voltage Test	U70 Rated : L6599ATD: 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) 15.1 V (2) 15.0 V (3) 15.1 V	P
5	Power Transistor ( D to S) or (C to E) Peak Voltage	Q1 Rated : IPW60R190C6 :650V/20.2A	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) 540 V (2) 516 V (3) 518 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 : 1.88 KVAC/min O/P-FG : 0.5 KVAC/min	I/P-O/P : 4 KVAC/min I/P-FG : 2.26 KVAC/min O/P-FG : 0.6 KVAC/min Ta : 25°C	I/P-O/P : 3.038 mA I/P-FG : 3.385 mA O/P-FG : 1.872 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
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C / 70%RH	16 mΩ	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-PE:4KKV	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-240-60 1. ROOM AMBIENT BURN-IN : 2.5 HRS I/P : 230VAC O/P : 95% LOAD Ta=31.9 °C 2. HIGH AMBIENT BURN-IN : 3.5 HRS I/P : 230VAC O/P : 95% LOAD Ta=60.0 °C			P																																																																																																																			
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>P/N</th> <th>ROOM AMBIENT Ta= 31.9 °C</th> <th>HIGH AMBIENT Ta= 60.0 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>TR-953</td><td>55.2°C</td><td>83.7°C</td></tr> <tr><td>2</td><td>LF2</td><td>TR915-R2</td><td>58.4°C</td><td>86.3°C</td></tr> <tr><td>3</td><td>BD1</td><td>US10KB80R</td><td>60.4°C</td><td>88.8°C</td></tr> <tr><td>4</td><td>C5</td><td>150u/450V 18*45 CST</td><td>58.3°C</td><td>85.8°C</td></tr> <tr><td>5</td><td>L2</td><td>TR-930</td><td>56.1°C</td><td>84.9°C</td></tr> <tr><td>6</td><td>C11</td><td>C/MPE 105/450V</td><td>59.0°C</td><td>86.3°C</td></tr> <tr><td>7</td><td>D3</td><td>1N5406</td><td>57.6°C</td><td>85.1°C</td></tr> <tr><td>8</td><td>D2</td><td>BYT79X-600</td><td>62.2°C</td><td>90.1°C</td></tr> <tr><td>9</td><td>L1</td><td>TF-6537</td><td>59.2°C</td><td>87.4°C</td></tr> <tr><td>10</td><td>Q1</td><td>IPW60R190C6</td><td>62.6°C</td><td>90.6°C</td></tr> <tr><td>11</td><td>U1</td><td>NCP1605DR2G</td><td>56.5°C</td><td>85.5°C</td></tr> <tr><td>12</td><td>C39</td><td>C/E 47u/25V 5*11 LE</td><td>56.1°C</td><td>84.7°C</td></tr> <tr><td>13</td><td>U70</td><td>L6599ATD</td><td>49.4°C</td><td>77.8°C</td></tr> <tr><td>14</td><td>Q3</td><td>STF26NM60N</td><td>63.1°C</td><td>91.3°C</td></tr> <tr><td>15</td><td>Q4</td><td>STF26NM60N</td><td>64.3°C</td><td>92.7°C</td></tr> <tr><td>16</td><td>T1</td><td>TF-6475</td><td>68.5°C</td><td>96.9°C</td></tr> <tr><td>17</td><td>Q101</td><td>V30200C</td><td>61.8°C</td><td>89.3°C</td></tr> <tr><td>18</td><td>Q102</td><td>V30200C</td><td>62.3°C</td><td>89.7°C</td></tr> <tr><td>19</td><td>C102</td><td>C/E 220uF/80V 10*23 ZLH</td><td>58.0°C</td><td>85.1°C</td></tr> <tr><td>20</td><td>C103</td><td>C/E 220uF/80V 10*23 ZLH</td><td>56.7°C</td><td>84.9°C</td></tr> <tr><td>21</td><td>C106</td><td>C/E 220uF/80V 10*23 ZLH</td><td>51.7°C</td><td>79.1°C</td></tr> <tr><td>22</td><td>LF100</td><td>TR950-R4</td><td>55.3°C</td><td>83.1°C</td></tr> </tbody> </table>	NO	Position		P/N	ROOM AMBIENT Ta= 31.9 °C	HIGH AMBIENT Ta= 60.0 °C	1	LF1	TR-953	55.2°C	83.7°C	2	LF2	TR915-R2	58.4°C	86.3°C	3	BD1	US10KB80R	60.4°C	88.8°C	4	C5	150u/450V 18*45 CST	58.3°C	85.8°C	5	L2	TR-930	56.1°C	84.9°C	6	C11	C/MPE 105/450V	59.0°C	86.3°C	7	D3	1N5406	57.6°C	85.1°C	8	D2	BYT79X-600	62.2°C	90.1°C	9	L1	TF-6537	59.2°C	87.4°C	10	Q1	IPW60R190C6	62.6°C	90.6°C	11	U1	NCP1605DR2G	56.5°C	85.5°C	12	C39	C/E 47u/25V 5*11 LE	56.1°C	84.7°C	13	U70	L6599ATD	49.4°C	77.8°C	14	Q3	STF26NM60N	63.1°C	91.3°C	15	Q4	STF26NM60N	64.3°C	92.7°C	16	T1	TF-6475	68.5°C	96.9°C	17	Q101	V30200C	61.8°C	89.3°C	18	Q102	V30200C	62.3°C	89.7°C	19	C102	C/E 220uF/80V 10*23 ZLH	58.0°C	85.1°C	20	C103	C/E 220uF/80V 10*23 ZLH	56.7°C	84.9°C	21	C106	C/E 220uF/80V 10*23 ZLH	51.7°C	79.1°C	22	LF100	TR950-R4	55.3°C	83.1°C		
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2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 95 % LOAD Ta= -40°C	TEST : OK	P																																																																																																																			
3	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 : 95% LOAD Ta= 60 °C HUMIDITY= 95 %R.H	TEST : OK	P																																																																																																																			
4	TEMPERATURE COEFFICIENT	± 0.03 % (0~50°C)	I/P : 230 VAC O/P : 95% LOAD	± 0.015 % (0~50°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~ +65°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 : 5G (5) Test Time : 72min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK	P
8	CAPACITOR LIFE CYCLE	HBG-240-60: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	(1) 511319.7 HRS (2) 48791.3 HRS (3) 61818.7 HRS	P
9	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE : 190.7KHRS		P
10	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase 70°C		P

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2013/02/26	PRODUCT SAMPLE	PASS	ZOULF	HOWAY

2009/08/04 A50-G058