



Test Report: HBG-160-48

160W 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 : 300 mVp-p (Max)	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	V1 : 45 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 : 3.312 A O/P= 48 V : 3.340 A	P
3	CURRENT ADJUST RANGE	CH1: 1.98 A ~ 3.3 A	I/P : 230VAC I/P : 115VAC O/P : CV MODE Ta : 25°C	1.603 A ~ 3.437 A /230VAC 1.600 A ~ 3.407 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 : 0.702 %~ -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 : 1%~ -1% (Max)	I/P : 230 VAC O/P : FULL ~MIN LOAD Ta : 25°C	V1 : 0.077 %~ -0.064 %	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/ 36.74 ms 115VAC/ 36.86 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/ 20.66 ms 115VAC/ 20.78 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) 376 mVp-p (2) 1820 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	0.408A	0.737A	1.053A	1.375A	1.692A	2.011A	2.330A	2.649A	2.969A	3.289A	
	%	12.36%	22.33%	31.91%	41.67%	51.27%	60.94%	70.61%	80.27%	89.97%	99.67%	
2	Dimming value	1V	2V	3V	4V	5V	6V	7V	8V	9V	10V	
	Output current	0.393A	0.708A	1.021A	1.332A	1.638A	1.950A	2.257A	2.567A	2.877A	3.241A	
	%	11.91%	21.45%	30.94%	40.36%	49.64%	59.09%	68.39%	77.79%	87.18%	98.21%	
3	Duty value	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
	Output current	0.428A	0.738A	1.051A	1.361A	1.668A	1.974A	2.281A	2.591A	2.898A	3.255A	
	%	12.97%	22.36%	31.85%	41.24%	50.55%	59.82%	69.12%	78.52%	87.82%	98.64%	

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) 0.92 / 277 VAC(TYP)	I/P : 230 VAC I/P : 115 VAC I/P : 277 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.971 / 100% PF= 0.996 / 100% PF= 0.948 / 100%	P
4	EFFICIENCY	93 % (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	93.23 %	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= 0.759 A/ 230 VAC I= 1.502 A/ 115 VAC I= 0.640 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= 58.73 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 : 0.3481 mA N-CASE : 0.3300 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	101.22 %/ 230 VAC 101.27 %/ 115 VAC Constant current limiting, recovers automatically after fault condition is removed.	P
2	OVER VOLTAGE PROTECTION	CH1 : 54 V ~ 62 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	58.0 V/ 230 VAC 58.0 V/ 115 VAC Shut down o/p voltage with auto-recovery or , re-power on to recover	P
3	OVER TEMPERATURE PROTECTION	SPEC : RTH2 : 100±10°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 : STF13NM60N: 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) 474 V (2) 452 V (3) 454 V	P
2	Diode Peak Voltage	D100 Rated : MBR30B150CTH: 150V/30A	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) 108 V (2) 11.0 V (3) 109 V	P
3	Input Capacitor Voltage	C5 Rated : 82u/450V 105°C 18*30 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) 440 V (3) 444 V	P
4	Control IC Voltage Test	U 2 Rated : L6599AD: 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) 14.1 V (2) 13.8 V (3) 14.0 V	P
5	Power Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : STF22NM60N :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) 486 V (2) 460 V (3) 464 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 : 2.966 mA I/P-FG : 2.816 mA O/P-FG : 3.653 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	23 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-160-60 1. ROOM AMBIENT BURN-IN : 2.5 HRS I/P : 230VAC O/P : 95% LOAD Ta=24.1 °C 2. HIGH AMBIENT BURN-IN : 3.5 HRS I/P : 230VAC O/P : 95% LOAD Ta=57.7 °C			P																																																																																																														
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>P/N</th> <th>ROOM AMBIENT Ta= 24.1 °C</th> <th>HIGH AMBIENT Ta= 57.7 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>RTH1</td><td>NTC 4A 5Ω 20%</td><td>58.5°C</td><td>89.9°C</td></tr> <tr><td>2</td><td>LF1</td><td>TR953-R1</td><td>46.9°C</td><td>78.4°C</td></tr> <tr><td>3</td><td>LF2</td><td>TR948-R5</td><td>49.6°C</td><td>81.9°C</td></tr> <tr><td>4</td><td>BD1</td><td>GBU608</td><td>53.3°C</td><td>85.2°C</td></tr> <tr><td>5</td><td>Q1</td><td>STF22NM60N</td><td>57.7°C</td><td>89.0°C</td></tr> <tr><td>6</td><td>D5</td><td>YG971S6R</td><td>59.4°C</td><td>92.8°C</td></tr> <tr><td>7</td><td>R8</td><td>R/NW 2W 0.062Ω 5%</td><td>55.6°C</td><td>89.5°C</td></tr> <tr><td>8</td><td>C5</td><td>C/E 82u/450V</td><td>55.1°C</td><td>88.9°C</td></tr> <tr><td>9</td><td>U1</td><td>NCP1608B</td><td>53.0°C</td><td>85.4°C</td></tr> <tr><td>10</td><td>C38</td><td>C/E 100u/25V</td><td>49.2°C</td><td>81.8°C</td></tr> <tr><td>11</td><td>U2</td><td>L6599ATD</td><td>51.5°C</td><td>85.1°C</td></tr> <tr><td>12</td><td>C61</td><td>C/E 47u/25V YXM</td><td>54.9°C</td><td>88.0°C</td></tr> <tr><td>13</td><td>RTH2</td><td>NTC 330KΩ</td><td>50.4°C</td><td>83.6°C</td></tr> <tr><td>14</td><td>Q5</td><td>STF13NM60N</td><td>57.0°C</td><td>89.7°C</td></tr> <tr><td>15</td><td>Q6</td><td>STF13NM60N</td><td>57.7°C</td><td>91.2°C</td></tr> <tr><td>16</td><td>T1</td><td>TF6524</td><td>60.7°C</td><td>93.1°C</td></tr> <tr><td>17</td><td>C103</td><td>220uF/80V ZLH</td><td>46.5°C</td><td>79.9°C</td></tr> <tr><td>18</td><td>LF100</td><td>TR884-R4</td><td>47.6°C</td><td>79.8°C</td></tr> <tr><td>19</td><td>C110</td><td>C/E 47u/100V ZLH</td><td>46.6°C</td><td>79.8°C</td></tr> <tr><td>20</td><td>D100</td><td>MBR30U150CTH</td><td>61.6°C</td><td>95.1°C</td></tr> <tr><td>21</td><td>D101</td><td>MBR30U150CTH</td><td>61.1°C</td><td>94.5°C</td></tr> </tbody> </table>	NO	Position		P/N	ROOM AMBIENT Ta= 24.1 °C	HIGH AMBIENT Ta= 57.7 °C	1	RTH1	NTC 4A 5Ω 20%	58.5°C	89.9°C	2	LF1	TR953-R1	46.9°C	78.4°C	3	LF2	TR948-R5	49.6°C	81.9°C	4	BD1	GBU608	53.3°C	85.2°C	5	Q1	STF22NM60N	57.7°C	89.0°C	6	D5	YG971S6R	59.4°C	92.8°C	7	R8	R/NW 2W 0.062Ω 5%	55.6°C	89.5°C	8	C5	C/E 82u/450V	55.1°C	88.9°C	9	U1	NCP1608B	53.0°C	85.4°C	10	C38	C/E 100u/25V	49.2°C	81.8°C	11	U2	L6599ATD	51.5°C	85.1°C	12	C61	C/E 47u/25V YXM	54.9°C	88.0°C	13	RTH2	NTC 330KΩ	50.4°C	83.6°C	14	Q5	STF13NM60N	57.0°C	89.7°C	15	Q6	STF13NM60N	57.7°C	91.2°C	16	T1	TF6524	60.7°C	93.1°C	17	C103	220uF/80V ZLH	46.5°C	79.9°C	18	LF100	TR884-R4	47.6°C	79.8°C	19	C110	C/E 47u/100V ZLH	46.6°C	79.8°C	20	D100	MBR30U150CTH	61.6°C	95.1°C	21	D101	MBR30U150CTH	61.1°C	94.5°C		
NO	Position	P/N	ROOM AMBIENT Ta= 24.1 °C	HIGH AMBIENT Ta= 57.7 °C																																																																																																															
1	RTH1	NTC 4A 5Ω 20%	58.5°C	89.9°C																																																																																																															
2	LF1	TR953-R1	46.9°C	78.4°C																																																																																																															
3	LF2	TR948-R5	49.6°C	81.9°C																																																																																																															
4	BD1	GBU608	53.3°C	85.2°C																																																																																																															
5	Q1	STF22NM60N	57.7°C	89.0°C																																																																																																															
6	D5	YG971S6R	59.4°C	92.8°C																																																																																																															
7	R8	R/NW 2W 0.062Ω 5%	55.6°C	89.5°C																																																																																																															
8	C5	C/E 82u/450V	55.1°C	88.9°C																																																																																																															
9	U1	NCP1608B	53.0°C	85.4°C																																																																																																															
10	C38	C/E 100u/25V	49.2°C	81.8°C																																																																																																															
11	U2	L6599ATD	51.5°C	85.1°C																																																																																																															
12	C61	C/E 47u/25V YXM	54.9°C	88.0°C																																																																																																															
13	RTH2	NTC 330KΩ	50.4°C	83.6°C																																																																																																															
14	Q5	STF13NM60N	57.0°C	89.7°C																																																																																																															
15	Q6	STF13NM60N	57.7°C	91.2°C																																																																																																															
16	T1	TF6524	60.7°C	93.1°C																																																																																																															
17	C103	220uF/80V ZLH	46.5°C	79.9°C																																																																																																															
18	LF100	TR884-R4	47.6°C	79.8°C																																																																																																															
19	C110	C/E 47u/100V ZLH	46.6°C	79.8°C																																																																																																															
20	D100	MBR30U150CTH	61.6°C	95.1°C																																																																																																															
21	D101	MBR30U150CTH	61.1°C	94.5°C																																																																																																															
2	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 95 % LOAD Ta= -40/-30°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	± 0.005 % (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	<ol style="list-style-type: none"> 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	<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	P
8	CAPACITOR LIFE CYCLE	<p>HBG-160-60:SUPPOSE C103 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 	<ol style="list-style-type: none"> (1) 666537 HRS (2) 59778 HRS (3) 97047 HRS 	P
9	MTBF	<p>MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE : 252.3KHRS</p>		P
10	DMTBF/Accelerated Life Test	<p>Demonstration Mean Time Between Failure(Expected Life) : 50,000 hours @ Tcase 70°C</p>		P

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2012/12/26	PRODUCT SAMPLE	PASS	ZOULF	HOWAY

2009/08/04 A50-G058